SCIENTIFIC AMERICAN

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A MODEL ELECTRIC RAILWAY PLANT.

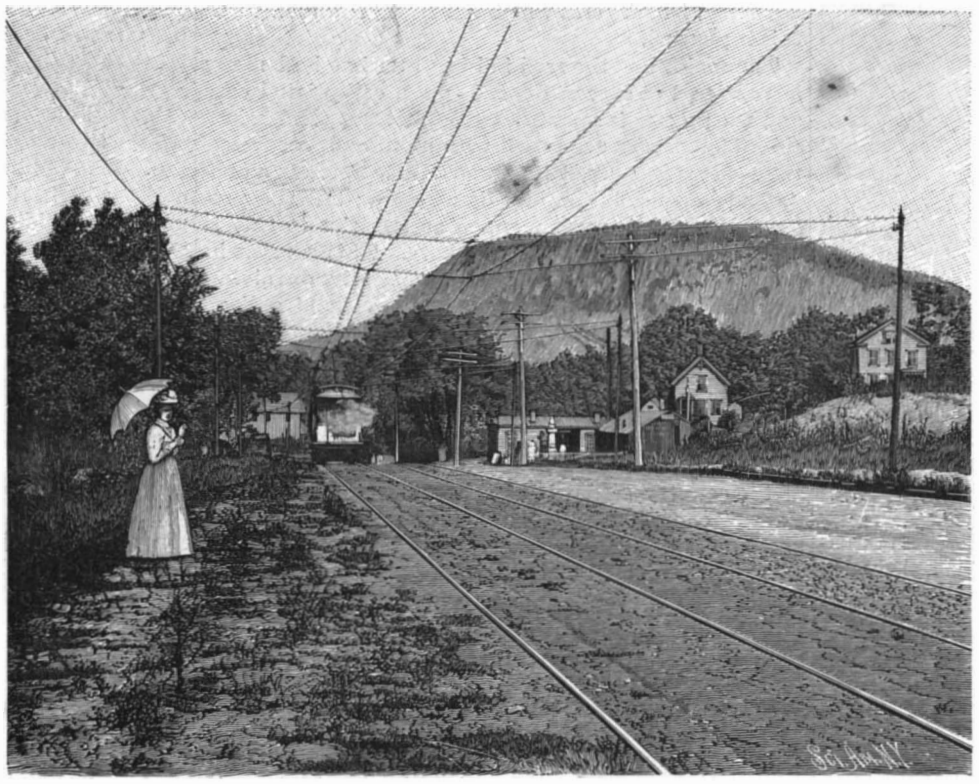
Trolley railways are now so common that it is taken as a matter of course that they are all pretty nearly alike, and that all that is necessary to constitute an electric railway is a source of current and cars provided with motors for using the current; but while the fundamental principles controlling the trolley systems of railways are the same on all roads of this description, there is a marked difference between the recent roads equipped with first class machinery and appurtenances and the earlier roads upon which the great problem of economical electric propulsion was worked out.

We present to our readers an illustrated description of a very complete plant located in New Haven, Conn., and belonging to the Fair Haven and Westville Railroad Company; in fact, the engines, machinery and general equipment of the road are so complete that we have ventured to call it a model trolley railroad.

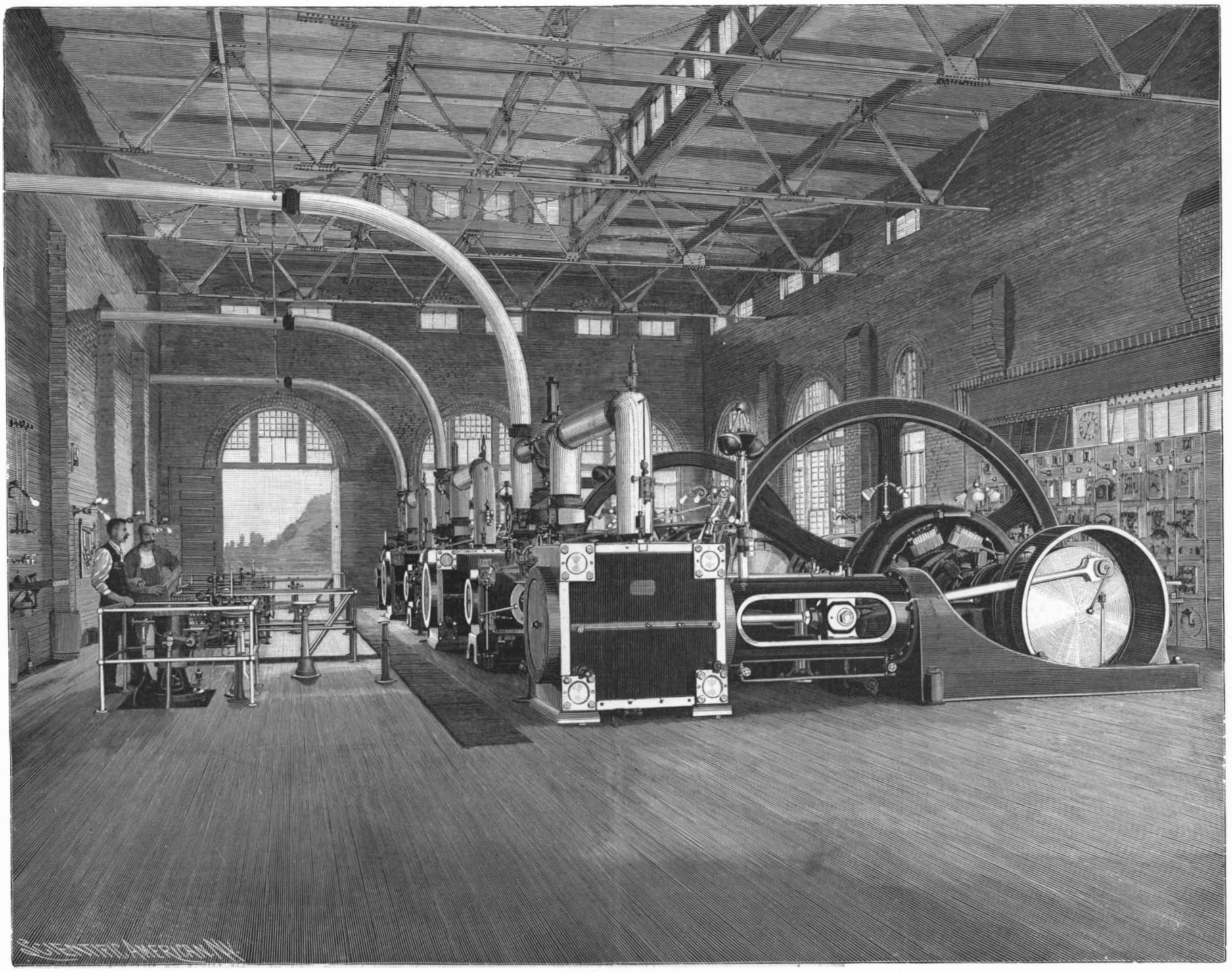
We give a view of a portion of the road showing Westville, with West Rock in the distance, and an interior view of the power house, showing the engines, dynamos and appurtenances. The power house is located on Mill River, in New Haven. Seven lines of railroad are operated from this station, employing 38 open cars, 42 closed cars and 3 sweepers. The combined length of the different branches is 25 miles. The power house is provided with three cross compound Allis engines, each having a stroke of 36 inches. The high pressure cylinders are 16 inches in diameter and the low pressure 30 inches. These engines are operated under a steam pressure of 120 pounds, and make 92 revolutions a minute. The pressure in the receiver between high and low pressure cylinders is 8 pounds; consequently the initial pressure in the low pressure cylinder is 8 pounds. The vacuum is 27 inches or 13 pounds.

Steam for these engines is generated by three vertical Manning boilers, another boiler of the same description being held in reserve

(Continued on page 265.)



FAIR HAVEN AND WESTVILLE ROAD.



FAIR HAVEN AND WESTVILLE ELECTRIC RAILROAD—INTERIOR OF POWER HOUSE.

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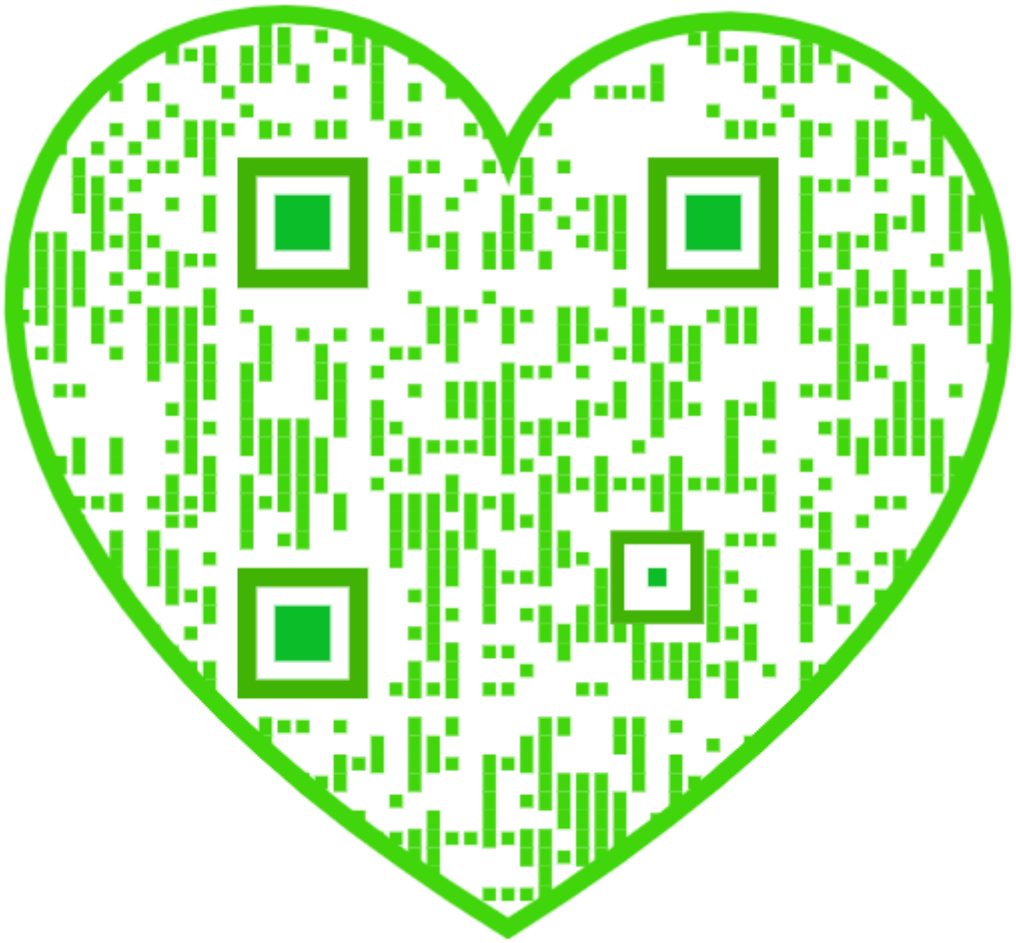

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PREVENTION OF RUST IN WHEAT.

Mr. E. B. Mayo, of V. Viesca, Coahuila, Mexico, in a recent letter complimenting the SCIENTIFIC AMERICAN, wishes to know whether there is any remedy or preventive for rust in wheat. The prevention of rust and smut of oats and wheat has been made the basis of a series of special investigations and experiments by a number of investigators, while the Division of Vegetable Pathology in the Department of Agriculture has particularly taken up the subject of smuts in oats and wheat. In Farmers' Bulletin No. 5 of that division the experiments of the division, as well as those made at the different State experiment stations, are summarized, the different methods having for object the treatment of the seed grain, since it has been found that infection takes place when the seed is germinating, from spores which adhere to the seed when this is planted.

The soaking of the seed in hot water has had many advocates, but success depends upon exceptional care and the process is somewhat complicated. Potassium sulphide has also been used with more or less success, the seed being soaked for twenty-four hours in a one-half per cent solution of this material; but the preventive which is recommended as superior to this is the treatment with copper sulphate. This consists in immersing the seed in a solution made by dissolving a pound of commercial copper sulphate in 24 gallons of water for twelve hours, and then putting the seed for five or ten minutes into lime water by slaking a pound of good lime in 10 gallons of water.

The bulletin above referred to concludes with the following statement: "These treatments have all been tried and have proved effective. In some parts of the country seed wheat is treated in strong solutions of copper sulphate, and no lime is used. This practice is much inferior, since it injures the seed, while those given here prevent the smut completely and at the same time do not injure the seed if carefully followed. In all forms of seed treatment care should be taken to spread the grain out to dry at once, and by frequent stirring prevent its spoiling. The treated seed should be handled only with clean tools, and should be put in sacks disinfected by boiling fifteen minutes. If these precautions are not taken, the seed may be infected again after treatment, especially in case of stinking smut of wheat. If the seed is to be sown broadcast, it will not have to be so dry as if it is to be drilled."

THE PROPOSED NORTH RIVER BRIDGE—THE GREATEST ENGINEERING UNDERTAKING IN THE WORLD.

The Secretary of War recently appointed a board of officers of the corps of engineers to "investigate and report their conclusions as to the maximum length of span practicable for suspension bridges, and consistent with an amount of traffic probably sufficient to warrant the expense of construction."

The leading features of the design upon which the estimate were made were as follows: A steel suspension bridge having a clear span of 3,200 feet between the towers and carrying six railroad tracks placed side by side. The floor of the bridge to be provided with a stiffening truss, which shall be hinged at the center and be 120 feet in depth. The bridge to be carried on 16 cables, arranged 8 on each side; each cable to consist of 6,000 parallel steel wires wrapped together and having a breaking strength of 28,440 tons; the diameter, inclusive of wrapping, being 21½ inches.

The strength of the bridge to be calculated for a rolling load of $13\frac{77}{100}$ tons per linear foot, and a wind pressure per linear foot of $1\frac{12}{100}$ tons.

With a factor of safety of three, the cables to be strained to 30 tons per square inch. For the stiffening truss a working stress of $7\frac{5}{10}$ tons to the inch to be allowed.

Working upon this data, the board deduced the following table of weights and cost for a 3,200 foot suspension bridge:

STRUCTURAL STEEL.

Suspended weights, in pounds	90,870,000
Towers	52,313,000
Chains and anchor plates	18,324,000
Total	161,507,000
At 4 cents per pound (1)	$6,460,280

WIREWORK.

Main cables and wrapping, in pounds	30,358,000
Backstays and wrapping	22,738,000
Suspenders	3,222,000
Total	56,348,000
At 7 cents per pound (2)	$3,942,260
Cost of superstructure (1 and 2)	$10,402,540
Cost of substructure (foundations, etc.)	11,784,000
Total cost of bridge	$22,186,540

From an engineering standpoint it is not the total length of a bridge that determines its magnitude, but the length of the individual spans. The cost and constructive difficulties of bridge building increase at a rapidly increasing ratio as the span is lengthened. The Tay bridge in Scotland is twice the length of the Forth bridge to the south of it: but the design and erection of its two miles of short girders did not call for the exercise of one-fifth part of the skill and courage required in throwing the huge spans of the Forth bridge across the mile of deep water at the Firth of Forth. In a like increasing ratio will the difficulties multiply in stretching this mammoth structure across the Hudson River.

The seven wonders of the world, that appealed so strongly to the ancients, will be completely overshadowed on every point of comparison by this crowning feat of the nineteenth century.

If mere bulk or mass be taken as the standard of comparison, it will be bigger and heavier than the greatest of the works of the ancients; and in the scientific knowledge involved in its construction, it will embody truths in chemistry, mathematics, and mechanics that would bewilder the Egyptian builders of the Pyramids even more than its vast stretch of steel cables and interlacing girders.

The two masses of masonry that will have to be built on shore to resist the enormous pull of the 16 cables will, in their united weight and bulk, rival the great Pyramid of Gizeh.

The four steel towers that carry the cables will each, in all probability, overtop the lofty Washington Monument; and will be exceeded in height only by one structure, the Eiffel Tower in Paris. Ethically, if we may so speak, they will stand loftier than the last named; inasmuch as the Eiffel Tower is merely a spectacular "freak," whereas the four great towers of this bridge will reach their full stature as part of a great mechanical structure erected for a useful mechanical purpose.

When loaded to its full working capacity, the bridge can carry in midair, at a height of 150 feet above the river, 17 heavily loaded freight trains, which, if strung out in line, would be two miles in length. This would represent a total load of 26,000 tons. Moreover, it could carry this load with a large margin of safety in a tempest of wind that would endanger the stability of many of the adjacent buildings in New York City.

It is fortunate, judged from the æsthetic point of view, that the great structure is to be built on the suspension principle instead of the cantilever, as was at one time proposed. Apart from the much greater weight and cost of a cantilever bridge, there is by comparison everything to be said in favor of the light and graceful appearance of the suspended bridge.

The lofty and tapering steel towers, with the cables rising in a long sweeping curve to meet them 500 feet in midair, will form a picture at once majestic and beautiful.

THE BATTLE SHIP INDIANA.

In placing the Indiana upon the list of available warships in the United States navy, the naval board will make the most important and significant addition to our fighting strength on the seas that it has ever known. In the Indiana we shall possess, for the first time, a first-class modern battle ship that can challenge comparison with any other armorclad afloat.

It is true there are in the English navy ships of 50 per cent greater displacement and 2 knots higher speed; but any superiority in this regard will be fairly well offset by the greater weight and more effective disposition of the armament in the boats of the Indiana class.

The displacement of the Indiana is 10,500 tons; that of the Royal Sovereign 14,900 tons; and yet the American ship can throw a much heavier weight of metal at a single discharge. The cause of this vast disparity in size is to be found in the different nature of the duties that have to be performed by the two types. The Indiana and her class are called coast defense vessels. They are designed for home waters, and their operations will be carried on as far as possible within easy reach of the home coaling stations. Consequently they will not need to carry more than a limited supply of coal, ammunition, and general stores. On the other hand, the world-wide distribution of England's maritime interests and the aggressive system of warfare which she has always aimed to carry on, seeking out and running down the enemy at sea, necessitate the building of battle ships of great coal endurance and capable of carrying a large supply of ammunition and stores for extended cruises at sea. All this necessitates an increase in size, and hence the mammoth proportions of such ships as the Royal George, which, when fully loaded, displaces 16,500 tons. The United States navy has no colonial interests to protect, and her battle ships are designed for the special purpose of guarding the home waters. For their purpose they are ideal ships; and ship for ship, they will be fully the equal of any European leviathan in a naval duel.

The Indiana is 348 feet long, 69 feet beam, and draws 26 feet fully loaded. A belt of steel 18 inches thick and 7 feet 6 inches deep protects her at the water line, 3 feet 6 inches of this being above and 4 feet below water. Above this belt of steel is a steel deck, 2¾ inches thick, which, with the side armor, will form a

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kind of huge inverted box, under which will be placed the "vitals," i. e., the engines, boilers, and stores of powder, shot, and shell. At each end of this armored box, and standing upon the steel deck, is built up a large "barbette," or round tower, of solid steel, 17 inches thick, within which will revolve the two steel turrets, 17 inches thick and 20 feet inside diameter. Each turret contains two steel guns, of a caliber of 13 inches, and 40 feet long, weighing 50 tons each. These four guns can each throw a shot weighing 1,200 pounds a distance of 12 miles, and can pierce 22 inches of steel at a distance of a mile. The Indiana could be off Rockaway Beach and throw shells into New York City.

A little distance behind these two main turrets, and placed one at each corner of the above mentioned armored box, are built up steel towers with armored steel turrets revolving at the top of them, in each of which are placed two 8 inch armor piercing guns. This is what, in battle ship parlance, is known as the secondary battery, and it is just here that the Indiana shows such a preponderance of fighting strength over other warships. In every other battle ship of foreign navies the secondary battery consists of guns of 6 inch caliber or less. These guns are not armor piercing, and the range of their destructive effect against a plated ship is limited. Not so the 8 inch guns of the Indiana. They are capable of piercing at close range all but the very heaviest armor afloat, and in a naval duel they would be the decisive factor of the fight. These eight guns are carried at a height of twenty-six feet above the water line, and could be fought in the heaviest weather without being interfered with by the breaking of heavy seas over the ship.

Between the 8 inch guns, and standing on the steel deck, are four 6 inch guns, which have a broadside and dead fore and aft fire. In addition to the heavy ordnance, the Indiana carries no less than thirty smaller guns, ranging in weight of shot from the 6 pounder down to the bullets of the Gatlings.

She is provided with tubes for the discharge of the deadly torpedo; and last but not least, she has a powerful underwater ram for ripping up the enemy's hull should a favorable opening occur in the confusion of a naval fight. To recapitulate, the Indiana's offensive strength is represented by four 13 inch 50 ton guns; eight 8 inch 18 ton guns; four 6 inch 5 ton guns; thirty smaller rapid fire guns; 18 inch discharges for torpedoes carrying 250 pounds of explosive.

The guns are so advantageously placed that, at a single discharge, she could hurl 6,800 pounds of shot into the enemy, with an average velocity of 2,000 feet per second.

On her trial trip, which took place on the 18th inst., she developed a speed of 15·61 knots over a thirty mile course, which is over half a knot in excess of the contract requirement. She was quick in answering her helm and showed good stability, two most important features in a battle ship. On page 264 we give an illustration of the Indiana.

Franklin L. Pope.

Franklin Leonard Pope was instantly killed by a shock of 3,000 volts in the cellar of his house at Great Barrington, Mass., October 13. He was the manager of the Great Barrington Electric Light Company, the principal buildings of which are at Housatonic, distant five miles. To facilitate the operations of the plant, he had placed in his cellar a large and powerful converter. When the power was turned on he visited the cellar to adjust the bearings. His family upstairs heard a heavy fall, and upon investigation found Mr. Pope dead on the floor beside the converter. Doctors say death was instantaneous.

Mr. Pope was born in Great Barrington in 1840. At an early age he was a telegraph operator. In 1860 or 1861 he came to New York, a green-looking Yankee country lad, to seek his fortune, and strayed into the SCIENTIFIC AMERICAN office, where employment was given him as a draughtsman. Here he gained knowledge of patents. Thereafter he entered the employment of the American Telegraph Company.

He was one of the earliest patent solicitors making electrical inventions a specialty, and for several years he held the office of patent attorney for the Western Union Telegraph Company. He was well known as a writer on electrical subjects. For several years past he was retained as an expert in some of the most important patent suits brought before various courts. In 1886 he was elected president of the American Institute of Electrical Engineers, of which he was a charter member, succeeding in that office the late Dr. Norvin Green. The reconstruction of the Great Barrington electric plant was one of his recent undertakings, and the work embodied many interesting features, which were described in a paper read by him at the June meeting of the Institute at Niagara Falls.

Mr. Pope leaves a widow and three children, two daughters and a son. His brother, Ralph W. Pope, is secretary of the American Institute of Electrical Engineers, and his son Henry W. Pope, is with the American Telephone and Telegraph Company in New York City. The funeral and interment was at Great Barrington.

Eugene Langen.

We regret to learn of the sudden death of Mr. Eugene Langen, one of the noted millionaires of Cologne, and one of the directors of the Otto Gas Engine Works, of Philadelphia, on the 2d inst., of heart failure, at his country seat, Elsdorf, not far from Cologne. Mr. Langen was one of the largest beet sugar manufacturers in the world, acquiring by that business about $20,000,000 in American money. Besides this he had a large business, and was a director of the Gas Motoren Fabrik Deutz, the largest of its kind in Germany. He had many decorations conferred upon him for his ingenuity and enterprise, one being from Emperor William I. He was only once in the United States, and that in 1894, when the firm of Schleicher, Schumm & Company ceased to exist, and the Otto Gas Engine Works were incorporated, which firm is now so well known throughout all the principal cities of the globe. He was about 60 years old, and leaves a family of twelve children, one of whom, Mr. Gustave Langen, is the president of above firm.

Progress of the Jerome Park Reservoir, New York.

The Ingersoll-Sergeant Drill Company have just received a large order for a complete plant of air compressing machinery for running drills, engines, pumps, etc., on the Jerome Park reservoir work, New York.

The contract for the construction of the Jerome Park reservoir was awarded to Mr. J. B. McDonald at $5,473,060. It involves the removal of upward of 3,000,000 cubic yards of rock.

The contractor has, since the letting of the work, made a thorough investigation looking to a determination of the question whether or not machinery for excavation can best be run by steam or from a central compressed air plant. The central plant system has been adopted as the best and cheapest, the saving in expense being largely in labor and fuel.

The plant made by the Ingersoll-Sergeant Drill Company and adopted by the contractor involves the use of compound condensing Corliss air compressors run by high class of boilers transmitting and distributing compressed air at 80 pounds pressure throughout the work.

It is contemplated to use a battery of several air compressors placed side by side, the unit adopted being a duplex compressor with steam cylinders 24 inches and 44 inches in diameter, 48 inch stroke, driving two piston inlet air cylinders, each 24¼ inches in diameter by 48 inch stroke, the capacity in free air of this machine being between 3,000 and 4,000 cubic feet per minute. This is a duplicate of compressor at work at the Anaconda mines, in Montana, where very economical results have been derived.

New Turbines for Niagara.

The Niagara Falls Hydraulic Power and Lifting Company have recently contracted with James Leffel & Company, of Springfield, Ohio, for four of their improved double discharge water wheels, to be of eight thousand horse power capacity, under a maximum head pressure of 218 feet, which is far the highest head under which turbines of large capacity have ever been applied in this country or elsewhere. These wheels will drive eight electrical generators, which will be connected direct to the turbine shafts, without gears or belting. This is the second order for turbines built by James Leffel & Company for Niagara Falls, there being already several of this make of wheel, each of 1,200 horse power, in daily operation in the Cliff Paper Company mills, located at the cliffs, near the tunnel. This water wheel company is also building four of their cascade wheels for one company, to be operated under 730 feet head; part of the power to be electrically transmitted by connecting the wheel shaft directly to the generators. The cascade wheel is, however, essentially and entirely different in construction and operation from the turbine, being in principle an impulse and reaction wheel. This cascade wheel plant will have an aggregate capacity of six hundred horse power.

Preservation of Chloroform.

L. Allain claims to be able to preserve chloroform indefinitely by saturating it with sulphur. Chemically pure chloroform is taken, and the sulphur is prepared from ordinary sublimed sulphur by leaving it in contact with four times its weight of pure caustic ammonia during twenty-four hours. It is then washed with distilled water until neutral to litmus, and placed in a stove regulated to a temperature of 40° C., where it remains for four days, after which it is further dried over sulphuric acid for fifteen days. Purified chloroform exposed to direct sunlight gave a precipitate with argentic nitrate solution after about forty eight hours, but underwent no change under similar conditions if previously saturated with sulphur, except that there was a deposit of insoluble sulphur. Specimens thus treated have been exposed to sunlight for four months without any alteration that could be detected by the usual reagents, and were found to cause perfectly normal anæsthesia in men and the lower animals, without accident. In diffused light the addition of one-thousandth part its weight of sulphur preserved chloroform indefinitely in the presence of a great excess of oxygen. No explanation of the phenomenon is offered, but it is intended to perform similar experiments with selenium and tellurium in place of sulphur.—Journ. de Pharm.

Cycle Notes.

English cycle repairers have recently introduced a new method of patching single tube tires. The patch is put on in the usual manner, and it is then vulcanized in place by means of electricity. The patch is thus rendered inseparable from the rest of the tire.

In France bicycles have been authorized for the distribution of telegrams, and an allowance of $3 a month is made to messengers for the use of their machines.

In Belgium the fire departments of some of the cities have utilized the tricycle as a hose cart, and find the results satisfactory.

By an ordinance, bicycle riders in a Western city are compelled to carry red lamps on their wheels at night, no other color being allowed.

At the National Institute for the Blind, in France, cycling is one of the amusements. A species of home trainer is provided, on which the inmates of the institution ride. The wheels are so arranged that the actual speed is indicated on a dial, so that races are held and some of the inmates have established records. The machines are also arranged so as to give audible signals at various speeds.

The Paris "Palais Sport" is a large arena with a cycle track that rises to a height of sixty-five feet in a spiral course. The ascent and descent are like a double corkscrew, and the tracks are so arranged that in one round trip a distance of one kilometer, or two-thirds of a mile, is covered.

Bicycles have been put to a novel use by Mr. F. A. Sirrine, the entomologist of the Jamaica, L. I., Agricultural Station. Mr. Sirrine rides a bicycle with a square reservoir of concentrated insecticide strapped to his handle bar and a knapsack spraying machine on his shoulders. He visits all parts of the island, giving object lessons to the agriculturists and horticulturists and imparting personal instruction to them in the preparation and use of the remedies which he finds to be efficient.

In the wheel room of the recently constructed palatial club house of the Century Wheelmen, of Philadelphia, 500 wheels can be accommodated.

A wheel should be cleaned and oiled at least once a week. To clean the wheel, remove the lamp, place the wheel upside down, resting on the saddle and the handle bar, which should rest on a cloth or piece of old carpet to prevent its being marred. Remove the dust from the wheel with a dry brush. If the rims and frames are muddy, use a wet cloth; a small brush will be found useful in cleaning the sand or mud from the hub and sprocket wheel. If the enamel of the frame appears streaked after washing off the mud, it should be rubbed with a dry cloth or a piece of chamois skin. Do not use oily rags on the enameled parts. The spokes should be cleaned with a cloth. Every month the chain should be removed and soaked in turpentine, followed by kerosene oil or in kerosene oil alone. The sprocket wheels should be thoroughly cleaned before replacing the chain. There are a number of chain lubricators on the market, including a mica lubricator, which will not soil the hands or clothes. Many wheelmen lubricate their chains with a semi-fluid preparation of plumbago and the solid graphite as well; only a small quantity of lubricant is required. After the bicycle is cleaned it should be thoroughly oiled and the bearings should be examined and tightened, if necessary. When the bicycle is put up for the winter, it should not be allowed to stand on the floor. It should be hung up with the tires partially inflated; this will tend to preserve the tires.

To ascertain the gear of a bicycle, multiply the diameter of the rear wheel by the number of teeth in large sprocket; divide by the number of teeth in small sprocket and the quotient is the gear of the cycle. For example:

28 rear wheel.
18 large sprocket.

224
28

Small sprocket, 8 } 504

63 gear of wheel.

ACCORDING to the Street Railway Journal, the number of street railways in the United States is 976, the total length of track being 13,588 miles, of which 10,363 miles are worked by electricity, 632 miles by cable, and 1,914 miles by horses, the remaining 679 miles being classed miscellaneous. The number of cars in service on these roads is 44,745, or 3·29 per mile.

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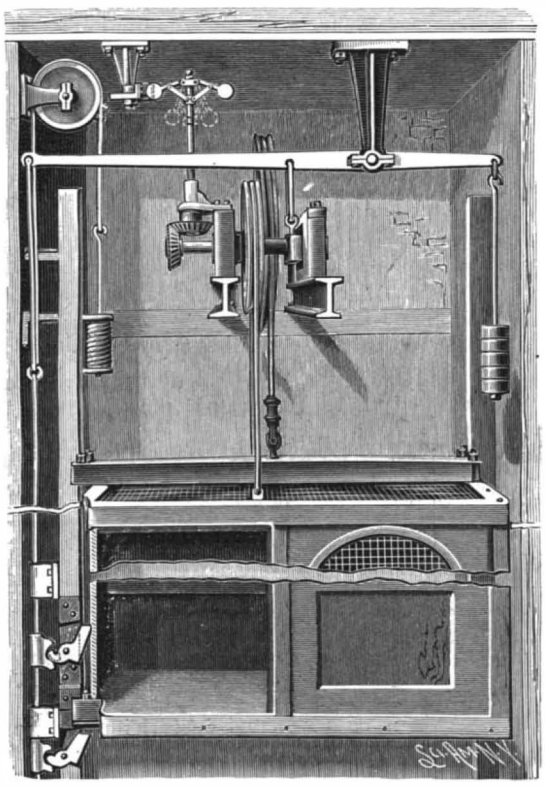
A SAFETY ATTACHMENT FOR ELEVATORS.

The numerous attempts which are constantly being made to find a satisfactory solution of the problems involved in the construction of a safety attachment for elevators which shall be at once simple, reliable, and economical, are a conclusive proof that the world is still waiting for the crowning achievement in this department of mechanics. It is, in fact, well understood by every one who has paid any attention to the subject that all the devices now in use fall very far short of doing for elevators what the air brake has done for railroads. Until at least the same standard of safety shall have been attained for vertical as for horizontal locomotion, the public have certainly a right to demand that manufacturers of hoisting machinery shall give every encouragement to inventors



LABATT'S ELEVATOR SAFETY ATTACHMENT.

who have this laudable object in view, and it is fortunate that the keen financial interest which the casualty insurance companies have in the efficiency of these contrivances is a guarantee that popular expectations in this respect will not be disappointed.

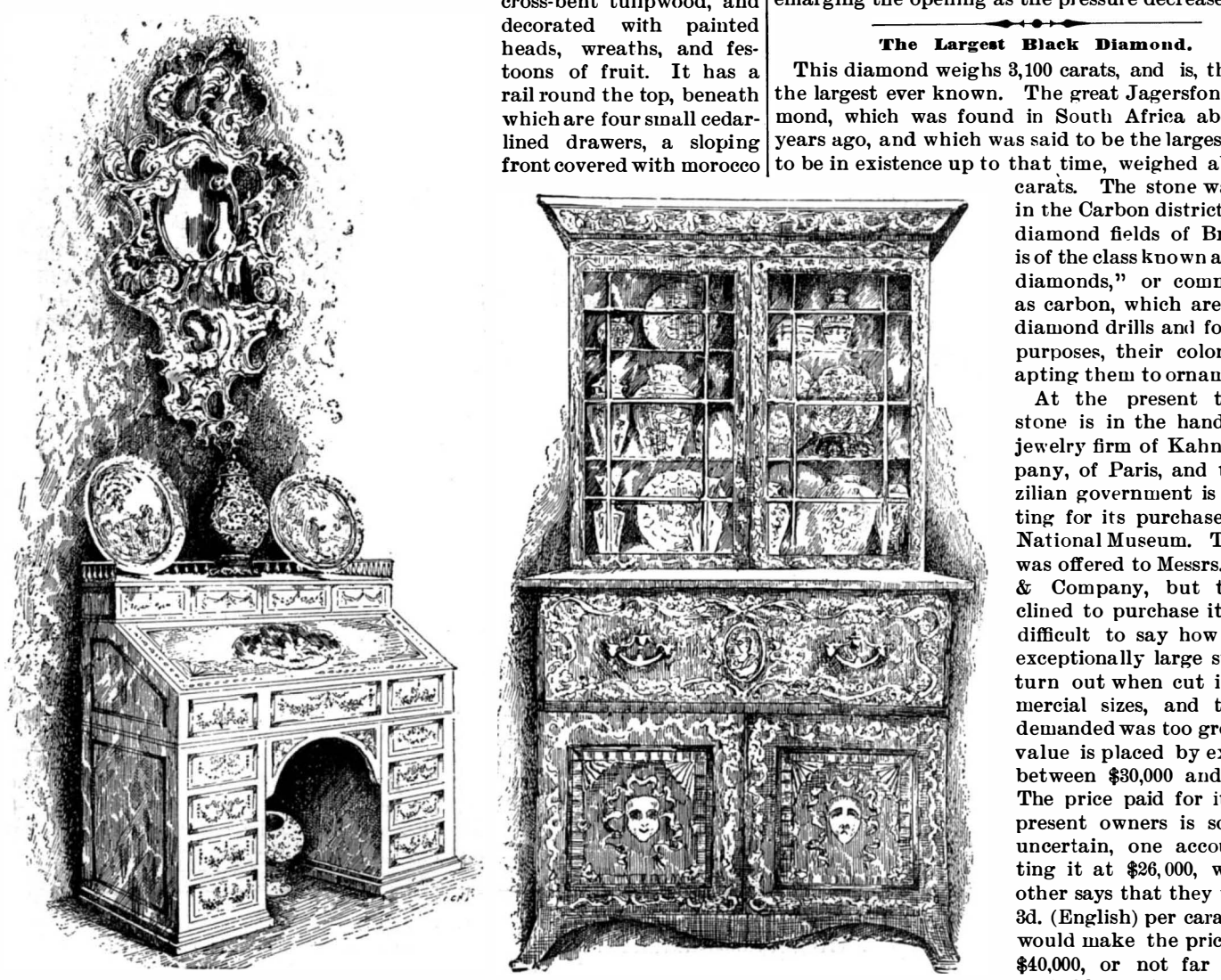
It is a peculiarity of the improvement shown in the accompanying illustration that the arresting apparatus designed to automatically stop the cage should the rope break, or should an unsafe speed be attained, is detached from and altogether independent of the cage. The improvement is readily applicable to any elevator shaft and cage, the mechanism being brought automatically into action either directly through the movement of the cage itself, or by controlling devices connected with the bearings of the drum over which the hoisting rope or cable passes. The invention forms the subject of a patent issued to Charles B. Labatt, of No. 143 West Fifteenth Street, New York City. In a vertical bar or beam at one side of the elevator shaft are recesses, at frequent intervals, in each of which is fulcrumed a safety catch of latch form, and when the shank portion of the catch is liberated or moved upward its body portion is carried outward into the path of the cage. On the other side of the latch beam are eyes, through which pass a trip rope on which are blocks adapted to engage the shank portion of each of the catches, these blocks normally holding the catches wholly out of the path of the car or cage. The trip rope extends over a pulley in the upper part of the shaft, and its end is connected by a rod with a spring, whose normal action is to draw the trip rope and throw the catches in the path of the cage; but this is prevented by the engagement of a lever with lugs in the periphery of the pulley. The lever is fulcrumed in a hanger, and is adapted to be engaged by the arms of a governor when the cage attains an unsafe speed, the lever being by this means disengaged from the lugs in the periphery of the pulley, when the spring draws upon the trip rope to throw the safety catches into the path of the car. The shaft on which is the drum wheel carrying the hoisting cable has at one end a miter gear meshing with a similar gear on the governor shaft, whereby the undue speed of the car expands the governor arms. The boxes in which the drum wheel shaft is journaled have a limited vertical movement, and one of these boxes is connected by a link with a lever fulcrumed upon a hanger, a weight being suspended from one end of the lever and its longer end being connected with the trip rope. On the breaking of the hoisting cable, the weight on the short end of the lever causes its other end to draw upon the trip rope and throw the safety catches out into the path of the car. The patent also provides for some modifications of the construction shown in the illustration, and the invention is in a measure an improvement on a formerly patented invention of the same inventor, whereby provision was made for projecting safety stops into the line of travel of the elevator in case of the breakage of the hoisting rope. The apparatus provides for the automatic stopping of the car before it can possibly attain a dangerous speed, and, if desired, provision may be made for lessening the shock of the impact of the cage on the stops by the use of springs or air cushions. It will also be noticed that, should the cage break through the first pair of stops meeting it in its descent, there will be another similar pair of stops waiting to meet it just below, and so on down to the bottom of the shaft.

ANTIQUE FURNITURE.

The perfection attained in the production of factory-made furniture within the last few years, and the comparatively low prices for which most elegantly finished articles are afforded, are the best proofs of the progress being made in the furniture trade. The styles, too, are now more varied than they ever were before, for, in addition to the new designs which the manufacturers are all the time originating, the copying of antique and classic designs is extensively followed in all work where the difficulty of execution does not prove too great an obstacle. The fact remains, however, that the best taste of the present day is most decided in its preference for old furniture of the classic styles of such makers as Chippendale, Manwaring, Mayhew, and other artistic workmen of the last century, and good samples of such work are always sure to command high prices. A collection of eighteenth century furniture recently exhibited in London, comprising secretaires, cabinets, tables, screens, etc., was well calculated to stimulate interest in such work, and we are indebted to the Furniture Trade Review for the illustrations and description herewith presented of two of the most important pieces in the collection.

The satinwood kneehole writing desk is inlaid with cross-bent tulipwood, and decorated with painted heads, wreaths, and festoons of fruit. It has a rail round the top, beneath which are four small cedar-lined drawers, a sloping front covered with morocco and painted with a group of Cupids in the style of Cipriani. Beneath is a long drawer, and there are four small drawers on each side of the recess. Hanging above is a Chippendale mirror with brackets for china.

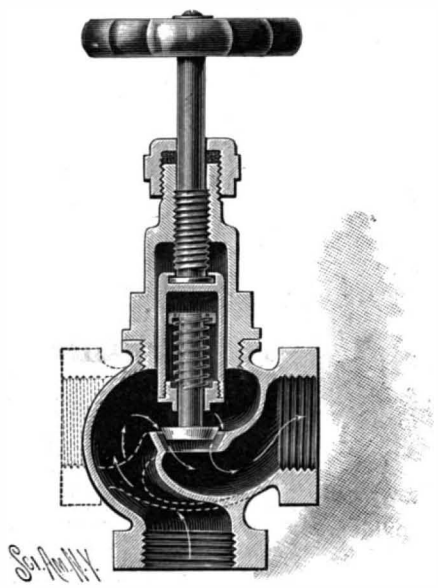
The mahogany secretaire and cabinet is in the Sheraton style. It has a secretaire drawer fitted with ten drawers and pigeon hole, a cupboard below with two paneled doors, inclosing sliding trays, and above are two glazed doors inclosing shelves. The whole is finely decorated with elaborate paintings of masks, medallions, wreaths, and ribbons, with exceedingly rich effect. This fine old example has had the interior restored and new lining added to the drawers, but the exterior is in as good condition as when it left the maker's hands, with the additional charm of softened tones that time alone can give.



ANTIQUE ENGLISH DESK AND MAHOGANY SECRETAIRE AND CHINA CABINET.

AN AUTOMATIC PRESSURE REGULATING VALVE.

A valve adapted to close proportionately on an increase of pressure and open correspondingly with decreasing pressure in the flow of gas or other fluid is shown in the accompanying illustration. It has been patented by Charles F. Sleigh and John M. De Long, of North Baltimore, Ohio. The valve seat is comparatively deep, and conical in shape, and the valve is held on a stem sliding loosely in a cap on the lower end of a cage which also slides loosely in the cap of the valve body, the cage being adapted to be raised or lowered by a threaded stem on which is a hand wheel. On the upper end of the valve stem is a cap against which presses a coiled spring, and an increase in the pressure of the gas flowing through the valve, causing an increased pressure also against the top of the valve, moves the latter downward against the tension of the spring, thus decreasing the opening between the valve seat and the valve, the spring lifting the valve and enlarging the opening as the pressure decreases.



SLEIGH AND DE LONG'S VALVE.

The Largest Black Diamond.

This diamond weighs 3,100 carats, and is, therefore, the largest ever known. The great Jagersfontein diamond, which was found in South Africa about two years ago, and which was said to be the largest known to be in existence up to that time, weighed about 970 carats. The stone was found in the Carbon district, the old diamond fields of Brazil. It is of the class known as "black diamonds," or commercially as carbon, which are used in diamond drills and for similar purposes, their color not adapting them to ornament.

At the present time the stone is in the hands of the jewelry firm of Kahn & Company, of Paris, and the Brazilian government is negotiating for its purchase for the National Museum. The stone was offered to Messrs. Bishop & Company, but they declined to purchase it, as it is difficult to say how such an exceptionally large stone will turn out when cut into commercial sizes, and the price demanded was too great. The value is placed by experts at between $30,000 and $40,000. The price paid for it by the present owners is somewhat uncertain, one account putting it at $26,000, while another says that they paid 52s. 3d. (English) per carat, which would make the price nearly $40,000, or not far from its probable maximum value.

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THE TIME IN CHINA BY THE SUN, WATER, AND FIRE.

While the sun and water have been more particularly employed by astronomers for telling the time, fire has specially served for indicating the vigils of the night. We have already had occasion to use this word vigils when speaking of clepsydras, and have referred to an ancient ordinance that enjoined the announcement of the vigils to the inhabitants by agreed-upon signals. We speak here of some customs that it is interesting to know about. The night was divided into five watches that began at sunset and ended at sunrise. As we have explained, these five parts were of greater or less length, according as it was winter or summer.

The announcing of the watches had a double purpose; in the first place it served to make the time known, and, in the second, to show that the watchman was on the alert. As it was formerly forbidden to walk about the streets at night, except in special cases, the guards had to keep watch and question every person who was met with outside of his house. Certain of these guards held in the left hand a hollow bamboo cylinder which they struck with the right hand, not only to give proof of their vigilance, but also to make the time known (Fig. 1, A, B). Sometimes this bamboo rod, instead of being cylindrical, had the form of a fish, 80 cm. in length by 15 in diameter. The officers who made the rounds often rode asses and were preceded by a soldier who carried a lantern.

Others had clappers attached to the arm, and to the number of two or more, leaving their post, went about acting upon them. The guards of a neighboring post answered them by striking the bamboo as above described. They thus proved that they were not asleep.

In 1668, Gabriel Magalhaens wrote, in his Nouvelle Relation de la Chine: "In all the cities and towns of the empire there are two towers, one of which is called the Drum Tower and the other the Bell Tower, from the top of which the night watches are announced. At the beginning of the night or of the vigil, the sentinel gives the drum several strokes, and the bell afterward answers him. Then, during the whole of the first quarter, the sentinel gives the drum a stroke and the other sentinel at once gives another upon the bell with the hammer. About the space of a Credo afterward, each of them gives the drum and the bell a stroke, and continues so to do up to the beginning of the second part of the night. Then each gives two strokes, and continues, as has been said, to the third watch, when they give three strokes. At the fourth watch they give four strokes, and at the fifth, five. At day break they redouble the strokes, as they did at nightfall. In this way, at whatever time of night one awakens, he hears, unless the wind be contrary, the signal of every watch and knows what the time is."

In the king's palace, at Pekin, there is to be seen a drum and a bell upon high towers, and, in the city, two other towers with a drum and bell for announcing the watches. The city drum is 15 public cubits* in diameter. The palace bell is the largest in the world, and its sound is so piercing that it seems to be rather that of some musical instrument than of a bell. It is this bell that serves for ringing the night watches in the city of Pekin.

The manner of sounding the hours by striking a bell by hand by means of some instrument was also employed in Europe, and of old in certain belfries deprived of a mechanical clock, the watchman struck the hour upon the bell according to the indications furnished by a clepsydra, sand glass or other device. While the watches were struck, these words were sometimes heard sung out: "Obey your parents, respect the aged and your superiors, and commit no injustice."

Fire, as we have said, was used in China for measuring the watches. The Chinese proceeded as follows: They reduced a special wood to powder by rasping and braying it. They thus obtained a sort of pulp of which they afterward made cords and rods of various forms (Fig. 1, C). For the use of rich and educated persons, they employed woods of rarer species. These rods, which were scarcely more than a finger in length, reached, when made of the more ordinary kinds of wood, two and three meters, and were about as thick as a goose quill. They were burned in front of the pagodas, and were used for carrying fire from one place to another. These rods were often stuck into metallic vessels filled with ashes. This vertical position permitted of following their combustion with the eye (Fig. 1, D).

Since these rods gave no light in burning, they were only used for giving the hour in the house, which they at the same time perfumed. When the rods or cords had a certain length, they were twisted so as to form a spiral and conical figure (Fig. 3) that widened out at every revolution and reached two or three palms in diameter. Their combustion then lasted several days, and sometimes even a month or more. They were suspended by the center and were ignited at the lower extremity. The fire then ascended slowly and insensibly in following all the spirals. Five marks made upon these spirals served to indicate the five parts of the night. This method of measuring time was, it is said, so exact that no error of any moment was ever detected. It is curious to compare this Chinese horary device with that employed in France in the middle ages. The duration of lighted candles or tapers also served then to mark the time of night. These candles were graduated just as the Chinese graduated their rods or cords. Saint Louis made use of this primitive method. Charles V also made use of these graduated candles.

The Chinese rods and cords spoken of above, while giving the time, also served as alarms. When a Chinese wished to rise at night at a given hour, he suspended a small weight of metal very exactly at the place in the rod or cord which the fire was to reach at the hour specified. The moment having arrived, the weight detached itself automatically and fell into a copper basin, and the noise of its fall was loud enough to awaken the sleeper. This method was as simple as it was economical, for a rod or a cord whose combustion lasted a day and a night cost but three farthings.

Fig. 2 represents a metallic dragon in the possession of the museum of the Louvre. It must have served only for the combustion of odoriferous rods.

We must now study what were the Chinese mechanical clocks with weights or motive springs in the seven-

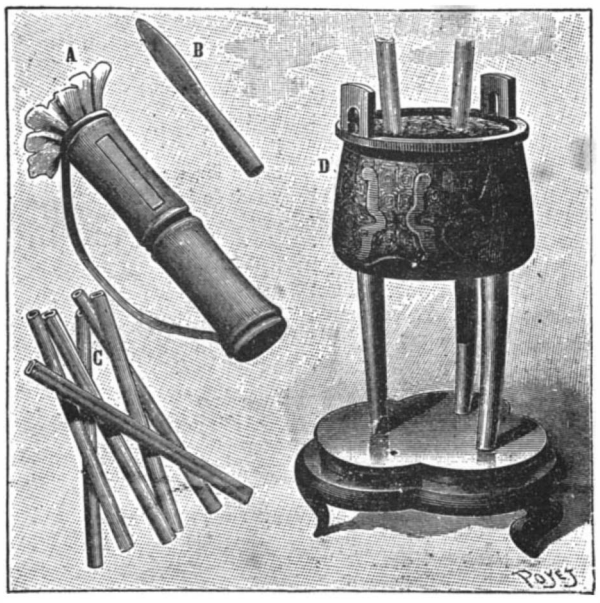

Fig. 1.—A B, BAMBOO FOR STRIKING THE NIGHT WATCHES. C. ODORIFEROUS BURNING RODS. D. METALLIC VESSEL WITH BURNING RODS.

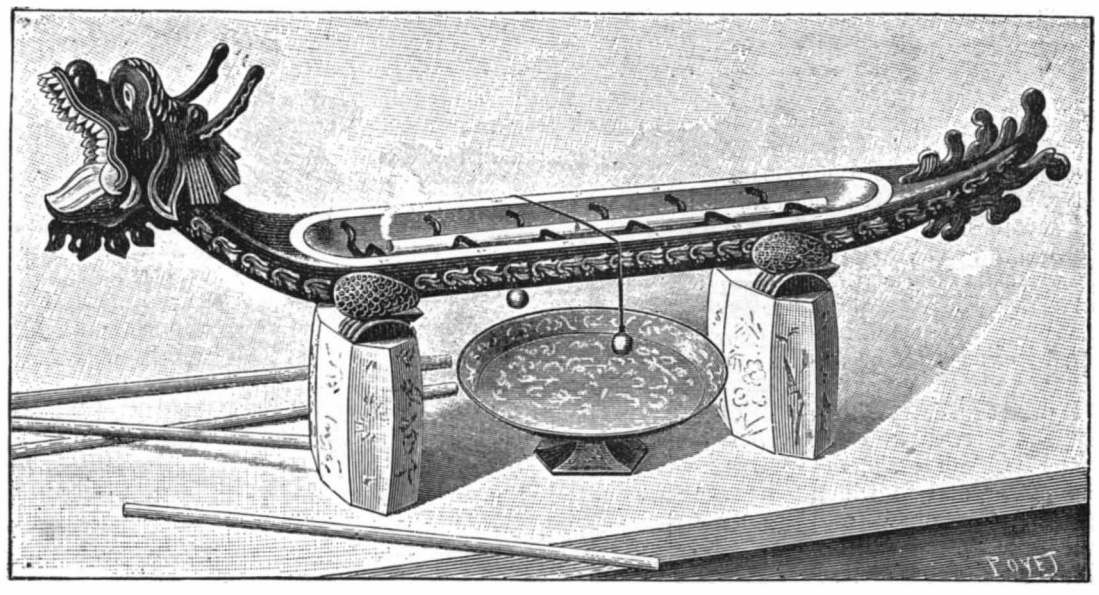

Fig. 2.—DRAGON FOR BURNING RODS TO MARK THE HOURS.

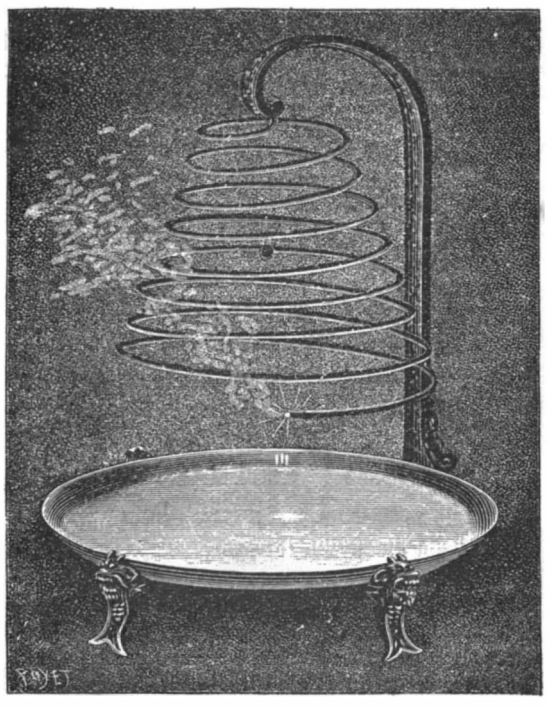

Fig. 3.—CHINESE SPIRAL FOR SHOWING THE TIME.

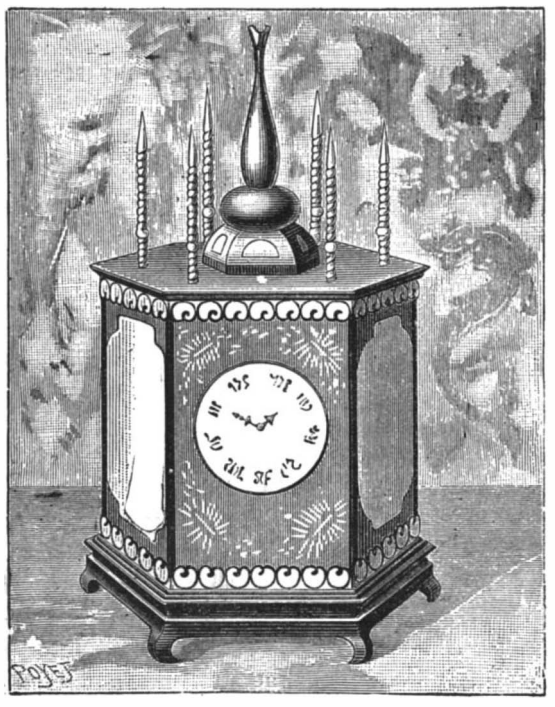

Fig. 4.—CHINESE CLOCK IN BLUE AND GOLD.

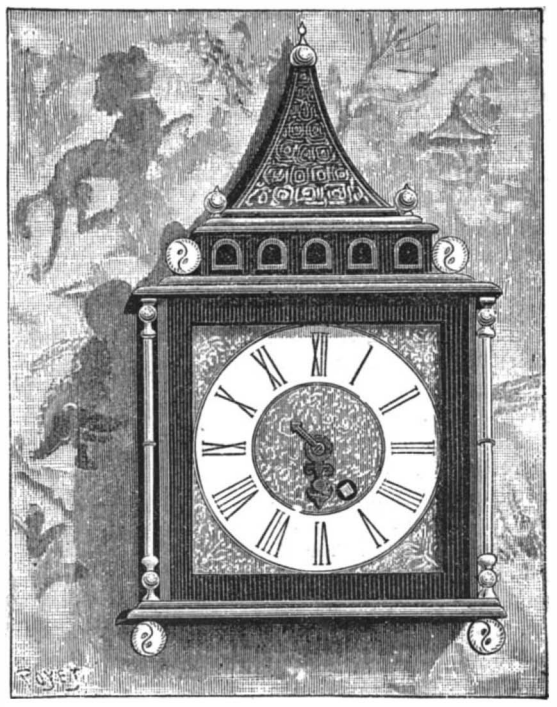

Fig. 5.—ANOTHER CHINESE CLOCK IN CARVED WOOD AND JADE.

* The cubit is a little less than a Paris foot, which was 30 centimeters.

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teenth century, the epoch at which the Chinese knew the first that were imported from Europe (1654). Upon this subject we read in the memoirs concerning history, science and arts by the missionaries of Pekin in 1782: The emperor, Young Tching, who reigned from 1723 to 1735, says in his preface to the sublime instructions of Cheng-tzu-Guogen:

"At the end of the Mings dynasty (first years of seventeenth century) Europeans having entered China, and having for the first time made one or two sun dials, the emperors of the Mings took them as a precious treasure. Toward the tenth year of Chun-Tchi (1654), the emperor Chi-Tzou-Hoang-ti received from these same Europeans a small clock which, of itself, struck the hours. It was not allowed to leave his side. Later on he obtained larger ones. Similar ones were made, as far as to external form and to internal wheels, but, since the method of working the springs so as to make them flexible and elastic was unknown, they were not correct.

"Since I have been reigning, having learned from some Europeans the method of working these springs, I have made hundreds and thousands of clocks that mark the time very correctly. I have had the striking clock mended that was first offered to the Emperor Chi-Tzou-Hoang-ti, and of which he was so jealous. It runs perfectly and I shall confide it to you presently. You, who are still young, have for your amusement ten or twenty of these clocks that strike of themselves and that I have given you. Do you not regard this as pleasing to you? You ought, then, to eternally recall, with a grateful feeling, the advantages that have been communicated to you by your ancestors and your father."

It was toward 1680 that Khang-hi created clock shops within the walls of the palace, and to which he called artisans and workmen from all parts of the empire. The monopoly of the trade was conceded to the Christian natives whom the missionaries had taught to work. These workmen, however, were not very skillful, for, more than a century afterward, three clocks presented to the emperor in 1795 by the embassy of the India Company, having been injured during the voyage, three clockmakers in the service of the court came to offer their services to the embassy; but the mechanic of the latter, not having been able to come to terms with them, refused their offer and preferred to them three missionaries residing in Pekin, whom he considered more adroit, although they were not of the trade. In fact, the repairs were properly made. When we study the pieces that the Chinese clockmakers have constructed, we find merely bad copies of European clocks. They have changed nothing in the movements adopted by them as models; and, as for the external form of the cases, they have given this, it is true, a Chinese character, but they have, nevertheless, produced nothing remarkable.

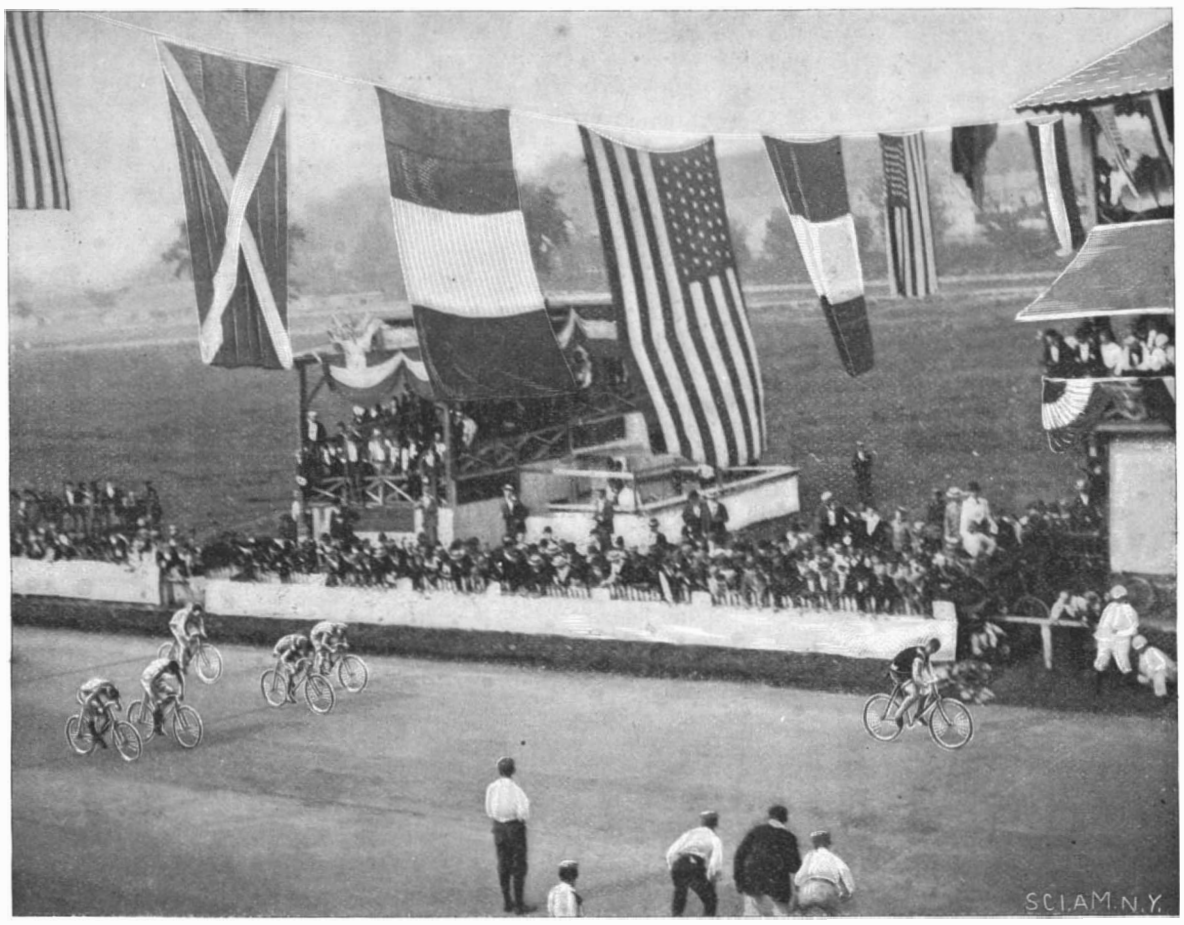
The Chinese have allowed themselves to be far excelled by the Japanese in mechanical finish and decorative art. The aspect of a Chinese clock sometimes revolts the eye through the mixture of Chinese and European elements found therein (Figs. 4, 5). The Chinese have produced no mechanical clockwork properly so called, but have been in this merely bad copyists.—La Nature.

Uses of Air Jets.

A writer in Cassier's Magazine states that in turning soft steel shafting, it is customary to use water to which a certain percentage of sal soda has been added, in order that the water may not rust the finished work, and with a keen tool of the proper temper, and wide enough cutting edge to cover the feed, a very smooth and shining surface can be produced. By using a small air jet, that is air issuing from an orifice of about one-sixteenth inch in diameter, the work can be finished very much the same as if water is used. A smooth surface will be produced with this important difference, that the tool will not crowd, and, consequently, the shaft will be nearer true and straight when using a compressed air jet than when using water. The same sized air jet may be used to advantage at different places around the shop. It is excellent for cleaning off benches and machines, and is much to be preferred to the common dust brush used for this purpose. It is also very convenient at the drill press for blowing out the chips in drilling and tapping bottom holes.

BICYCLE RACING AT SPRINGFIELD.

The programme of races of the Springfield Bicycle Club at its September tournament was one of unusual interest, and attracted the attention of wheelmen in all sections of the country. Many of the leading professional and non-professional bicycle riders participated, and the attendance was very large. This tournament has been styled the "American Cycling Derby," and our illustration represents the conclusion of the mile open race on the second day, with Walter C. Sanger winning. It has been generally conceded that Sanger rode the greatest races of the year on this track, and that he stands far above the common run of cycle racers, but it is said that Sanger personally lays great emphasis on the merits of the tires which he rode in these trials. They were the Vim tires made by the Boston Woven Hose and Rubber Company, and their peculiarity consists in a roughened surface, technically called a pebble tread, giving the tire a high speed record. Sanger entered and won in three events, the two mile handicap in which he won on the second day being a highly sensational and brilliant performance. The advantage of the pebble tire was well shown in the race we illustrate. The bunch came slowly, round the turn toward the open with half a dozen men in front of Sanger and Tyler. Sanger was very near the last man in the string. Directly on the point of the turn, the bunch began to go fast, and so great was their speed when they got to the head of the stretch that they had to swing wide, owing to the smooth surfaces of their tires. Sanger, having the roughened surface, simply held to the pole very closely, and by the time the rest of the bunch was ready to slide in toward the pole, Sanger was a good ten feet ahead of them. It was but an easy matter for him then to increase his lead until he finished far ahead, as is shown in the cut. Had his tires not been furnished with the pebble tread, he would have been obliged to have followed the bunch into the stretch, and lost the position which the tires gave him.



SANGER WINNING IN A BICYCLE RACE AT THE SPRINGFIELD MEET.

Not a Bad Idea.

In Germany when a man is convicted of the offense of beating his wife he is not locked up at once, but is allowed to continue at his work all through the week. At the end of the week he is looked after by the police, who put him into prison until Monday morning. His wages are taken from him and delivered up to his wife. On Monday morning he is handed over to his employer. If he will not then work, he is thrown into jail again, where, says the Newcastle Chronicle, there is no doubt he will have to work a great deal harder than he does when at his usual employment. In some countries this would be regarded as intolerable paternalism.

The Michigan Spread Eagle.

At the recent meeting of the American Bar Association at Detroit, Michigan, the address of welcome was delivered by Hon. Don M. Dickinson, who glorified the town and State as follows:

"A few days ago a Senator of the United States from the great State of New York referred to the city of Detroit as situated on the shores of Lake Michigan!

"Now, we would have him know, and all the rest of our friends of the Atlantic coast who have never been west of Buffalo know, that a commerce passes the port of Detroit in but the seven months of open navigation seven times as great, in tonnage of merchandise, as the entire year's carrying trade of the North Atlantic highway, and more than twice as great as the combined entries and clearances of the whole world at the ports of New York and Liverpool together. In the summer of 1893 a member of the Supreme Court of the United States—one of the most eminent men produced by this republic, and one of the greatest judges who ever wore the ermine—spent a month within sight of the two endless processions of shipping that pass each other on this water road. Mere statistics had not greatly impressed him, but the actual view of the living facts filled him with astonished conviction. To that visit more than any thing else, I believe, does our fresh water Neptune owe his belt and spur of knight; for in December, 1893, the court gave to our lakes and connecting rivers the full legal title and dignity of 'high seas,' ranking with the oceans and seas of the world. I say, in passing, that now, with our sister States of the Northwest, we are asking, with more and more urgency—nay, we will soon demand—from the United States, a free and, above all, a wholly American outlet to tide water, so that we may ship our goods to every open port on the earth without change of bulk.

"In agriculture, Michigan's resources can feed all the nations; in building material, we can build cottages and palaces for them all; we can gridiron the world with our iron and steel; and from our manufactories can equip the lines with rolling stock. We produce the most and best iron of any State or nation.

"Our copper product is now at least half of the world's supply. Copper mining is remunerative, but I suggest to our fellow citizens of the United States from abroad that it would pay us better if the government would open its mints to the free and unlimited coinage of copper as money, impose the legal tender quality, fix a ratio (at any figure—that is not material) with gold and silver, and then maintain the parity of the three metals with all the financial resources of the republic, 'independently of and without waiting for the assent of foreign nations.' Michigan would like this, and if it should turn out well, we might, following Lycurgus, try it with our iron by and by. But that's another story, as Kipling would say."

Tuberculosis.

Professor Delépine, writing on this subject, has shown that—taking very large numbers as the basis of his estimate—at least 16 per cent of cattle are afflicted with this disease; and that, whereas in some districts it may be comparatively rare, there are parts in which a non-tuberculous cow is the exception. Pigs also are affected in the same manner, although not to the same extent, about one in every thirty-six being attacked by the disease. Cats and dogs also are subject to tuberculosis, and it is to be feared from their exceeding friendliness may be a source of danger to children with whom they play. Although the form of tuberculosis with which poultry are affected differs in some particulars from that of man, it is a very common disease, and commits great ravages in poultry yards. But any animal which conforms with man's habit of dwelling under artificial shelter is apt to contract tuberculosis, and so it is that whether they be monkeys, camels, giraffes, antelopes, llamas, lions, tigers, foxes, tapirs, zebras, etc., they all, according to Professor Delépine, are liable to tuberculosis when they are kept in menageries.—Hospital.

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Correspondence.

How to Hinder Railway Robberies.

To the Editor of the SCIENTIFIC AMERICAN:

I wish to call attention to two plans to frustrate such designs.

First, by fixing a pipe to the steam dome to convey steam near the lamps on the train and then by jets or small pipes pointing downward into the lamp chimney all lights on the train could be instantly extinguished by a move of the engineer, and robbers could not see trainmen or passengers to hold them up or shoot them, while they would be fully exposed as they would advance.

My next device would be to carry all valuables in metal cans instead of paper packages, of any weight experience would approve of. When a safe was blown open, these packages would be too heavy to carry and difficult to open, and could not be destroyed. Large gas pipes, with heads screwed in, one head riveted in and the other locked securely. Such packages would be difficult to carry off or open or dynamite.

I hope you will give your readers these ideas for the protection of trains and the inconvenience of robbers.

BENJAMIN WALTON.

Compton, Cal., October 2, 1895.

Photography Out West.

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in reading in a late number of your paper Mr. Buckwalter's article on photography in the Rockies. I can quite confirm what he says about the danger of overexposure. When I began the art here as a novice, the smallest stop in my lens was about f 32. With this stop and an exposure made by lifting off cap quickly and as quickly replacing it, the negatives obtained, when the landscape or object was in bright sunshine, were almost invariably spoiled by overexposure. I finally made a smaller stop and then got good pictures. I find ordinarily that f 64 is as large a stop as can be used safely with a cap exposure for a brightly illuminated landscape. With the shutter (S. and P.) working at $\frac{1}{40}$ sec. f 16 to f 11 give fully exposed negatives. I use Cramer's Banner plates, which are very rapid, though not so much so as his Crown brand. I have seen films of another make rated at sensitometer 27, which were underexposed under the same conditions.

Perhaps the ordinary tourist would succeed best here by bringing a slower plate than he generally works with. There is not the same latitude in exposure, required at lower levels for different times of the day, needed here. The sun generally rises and sets almost at maximum brightness. I have got overexposed negatives half an hour after sunrise on a zero morning with f 32 and quick cap exposure. I have not found isochromatic plates of any advantage here so far, and yellow screens with ordinary plates are useless, except for clouds, as they intensify the lights, while destroying detail in the shadows. There is one thing has puzzled me. These overexposures spoken of were helpless ones; not to be saved by any amount of bromide of potash in the developer nor by dilution of it. But now and then under just the same (apparent) conditions—bright sunshine, f 32 stop, the same exposure and developer—a good negative was obtained. I suppose either the actinic power of the light must have been less, though the eye could not appreciate it, or else the plates varied, which seems unlikely.

W. DEARDEN.

Trinidad, Col.

The Father of Ocean Steam Navigation.

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in the article on "The Earliest Transatlantic Steamships," given in your issue of September 21. I was especially impressed by it, as I am visiting in the family of Dr. Junius B. Smith, the originator of ocean steam navigation, and have seen papers and documents by means of which I may possibly be able to give you a few additional items of interest upon the subject, and at the same time do justice to the memory of a profound and practical thinker, whose foresight and perseverance helped the world to so wonderful an advance.

Junius B. Smith was born in Connecticut and was graduated from Yale in 1802. He went early to London and transacted business between that city and New York for over forty years. He crossed the ocean several times, and on one occasion had a voyage of sixty days. This led him to reflect upon the importance of deep sea navigation, and in 1833 he began to advocate the use of steam in crossing the ocean among business men and bankers. His project was received at first with indifference and even scorn. Dr. Dionysius Lardner, who was lecturing at the time upon scientific subjects, spoke publicly of the "chimera" of hoping to cross the Atlantic in a steamship without a coaling station midway. Even the Duke of Wellington, to whom he applied, answered that he "would give no countenance to any schemes which have for their object a change in the established system of the country"! After great effort he succeeded in organizing the "British and American Steam Navigation Company," and secured a list of directors. The books were opened in 1836. The contract for building the ship was given to Messrs. Curling & Young, Blackwall, England, and the contract for the engine was made with Messrs. Claude, Girdwood & Company, of Glasgow. The latter failed after finishing about two-thirds of the work, which delayed the enterprise a year. In the meantime, in order to prove the feasibility of his project and to anticipate the sailing of the Great Western, built by a rival firm who had adopted Dr. Smith's idea, the Sirius, a small steam channel packet, was chartered and made the trip to New York just ahead of the Great Western.

In regard to the claim for the Savannah, that she was the first steam vessel to cross the Atlantic, Dr. Smith wrote that he had visited and examined her, that she "was completely ship-rigged and made no pretensions to having navigated the ocean by steam, having sailed most or all of the way and carrying her steam engine with her, as any other ship might do."

An editorial in the New York Evening Herald, dated October 18, 1838, and which is now before me, expressly gives Dr. Smith the credit of making "the first effort to turn the attention of England to Atlantic steam navigation," and the next day's issue of same paper publishes the correspondence between Dr. Smith and a company whom he wished to influence upon the subject. Another long and detailed article in the Journal of Commerce, dated February 12, 1853, just after the death of Dr. Smith, speaks of him as "the father of ocean steam navigation."

There seems, therefore, to be no doubt that Junius B. Smith was the first to entertain and carry out the plan of applying steam to regular ocean navigation, and that but for the delay caused by the failure of the firm employed to build his engine his would have been the first steamer between England and United States.

I may add that Dr. Smith's company afterward built and sent out the steamships British Queen and President.

JULIA L. BISHOPRICK.

Burlington, N. J.

Firing of Boilers with Mixed Coal.

To the Editor of the SCIENTIFIC AMERICAN:

By an article in your issue of September 21 (current volume) an attempt is made to show how a revolution can and ought to be made in the firing of steam boilers. The results recorded therein are certainly most remarkable, if we consider only the resulting figures; but if we stop to analyze them, they are shown to be very misleading.

That it is possible to utilize more heat from the combustion of certain combinations of different fuels, under certain conditions, than from other combinations, or from some one kind, is an axiom.

When it is found that some combinations of coal give better results than other combinations, or any one kind, there is surely some reason for it. No more heat can be evolved by the combustion of one pound soft coal culm mixed with four pounds of hard coal screenings than can be evolved by the combustion of five pounds of run-of-mine soft coal, provided combustion is perfect in both cases.

In firing steam boilers, two conditions must be fulfilled to insure maximum efficiency. First, the coal must be burned; second, the heat evolved must be absorbed by the water in the boiler.

That the coal shall be burned means that the combustion shall be perfect. When a chimney discharges smoke, it is evident that the combustion is not perfect. If the combustion is not perfect, it is proof positive that insufficient air has been admitted to the furnace or combustion chamber, or if sufficient air has been admitted, the temperature at which it mingled with the fuel, whether in a solid or gaseous state, was not high enough for oxidation. In very few cases is too much air admitted to the furnace of a steam boiler.

In the usual process of burning coal in the furnace of a steam boiler, a distillation and combustion is produced in which, at almost all times, some part is below the oxidizing temperature. The fresh fuel is usually delivered to that part of the furnace to which no air can penetrate without first passing through the highly heated portion in which the oxygen is consumed. The result is that the heat from this combustion distills off or sets free the volatile portion of the fresh fuel, and there being no oxygen with which it can combine, it passes off unoxidized. In order to produce perfect combustion, the volatile portion of the coal that is set free by the first application of heat must be brought into that part of the furnace which is at or above the oxidizing temperature, and simultaneously mingled with sufficient air to cause complete oxidation.

With a furnace so constructed that these results could be effected, the problem of getting the heat into the water in the boiler would be much simplified, since the efficiency of the heating surfaces would not be impaired by the presence of soot.

Thus we see that neither condition of maximum efficiency was in any way approximately fulfilled in the case described by the writer of the article above referred to. He stated that the chimney had, before the use of mixed coal began, discharged large volumes of smoke. This condition alone is enough to destroy the efficiency of the boiler. He also states that previous to the time of using mixed coal, they had insufficient boiler capacity and that the result he gives can only be obtained with plenty of boiler capacity. It is evident from this that they have increased their boiler capacity since using the mixed coal. It is equally evident that in the first case they did not burn the coal. In a case of this kind the remedy is to so construct and manipulate the furnace that the combustible will all be burned. Then the difference in cost between the different fuels will be simply in the cost per pound of combustible.

In general, if the efficiency of a steam boiler regarding the cost of evaporating a pound of water is not what it should be, the first thing to do is to find if the cheapest kind of fuel that can be obtained, in proper quantities, and that is applicable to the conditions, is being used. If this is found to be the case, the next thing is to ascertain if it is all being burned. If this is found to be the case, then there is but one more thing, and that is, does the heat of combustion get into the water in the boiler, or does it go somewhere else, up the chimney or out through the brick work, or somewhere where it is not useful. When these three conditions are being fulfilled in the highest degree, then the highest efficiency has been reached. If they have not been fulfilled in the highest degree, then the efficiency is below the maximum.

Thus we see in the case cited in the article above referred to a gain was made at all three points: First, the hard coal screenings were cheaper per pound of combustible, which means more heat units for a given amount of money; second, by the change, owing no doubt to the changed conditions of boiler capacity, etc., combustion was made more perfect, which meant more heat units evolved; and third, the heat of combustion was more perfectly taken up by the water in the boiler, owing to the improved condition of the heating surfaces. Under these conditions, the result obtained is not at all remarkable. If combustion had been perfect in the first case, the result would have shown only the saving due to the difference in the cost of combustible per pound.

There is another and very good reason why this method will not revolutionize the firing of steam boilers. The quantity of hard coal screenings is limited. At no point other than shipping and receiving points of hard coal can they be obtained in any quantity that would supply even the smallest steam plant. At the largest shipping and receiving points they are to be had only in very limited quantities.

Duluth, Minn., is the receiving point of practically all the hard coal used in the Northwest. An attempt was made at one time to burn hard coal screenings in one of the plants of the Twin City Rapid Transit Company of Minneapolis and St. Paul, obtaining the supply from Duluth. The apparent result showed great economy, owing to the low prices of hard coal screenings. It was soon found, however, that the entire supply of this port was insufficient for one 3,000 horse power plant, and the scheme had to be abandoned.

Now, why will a person attempt to startle the world by making a statement that a result had been obtained which ought to revolutionize the great industry of firing steam boilers, when on its very face the statement shows that the conditions were not properly dealt with?

If all questions of fuel economy were taken up as they should be and figured out on some such line as herein set forth, there would be fewer wild statements about phenomenal results being obtained.

The question of fuel economy is one that is well worth the serious consideration of any one interested, and is one not to be dealt with lightly, or in an unscientific manner.

W. COOPER.

797 State Street, Schenectady, N. Y., October 8, 1895.

The Echo Organ at Westminster Abbey.

This organ, presented by Mr. A. D. Clarke, has now been fixed in the triforium above Tennyson's monument, and is almost completed. The new instrument is electrically connected with the main organ, and the same engine supplies wind to both. The electric wires by which the connection is made are carried from the organ to the echo instrument incased in a small leaden pipe, while a larger pipe taken up through the roof gives the connection between the bellows and the echo pipes. A new keyboard has been added to the already complicated main organ (making five manuals in all), and there are electrical contrivances in great variety, by means of which couplings and stops are put into or out of action. Despite the distance separating the two instruments, the effect of touching the keys on the new manual is instantaneous, and the echo organ is as sensitive in responding as is the main instrument.

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Patent—Infringement—Suit.

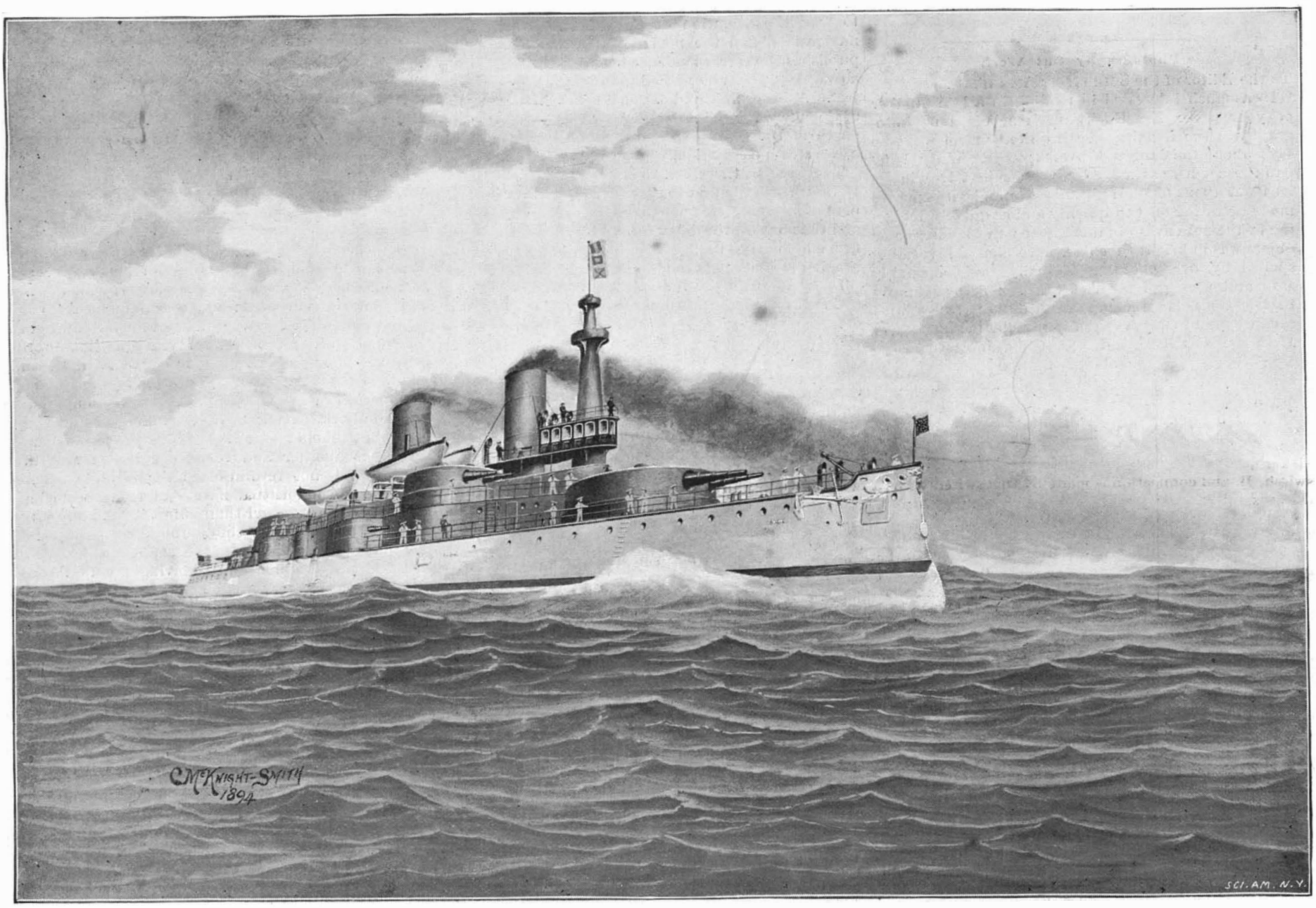
The case of Hall, receiver, vs. Traders' National Bank, recently decided by Judge Colt, of the United States Circuit Court at Boston, was a suit for the infringement of a patent which came up on a motion to dismiss the suit on the ground that by reason of the death of the defendant the suit had abated and cannot be revived. The judge said: "When a person wrongfully appropriates a patented invention, it is an invasion of the patentee's right of property, and the gains or profits derived from such piracy belong to the patentee. Because the machine in which the wrongdoer may have embodied his piracy may not belong to the patentee does not affect the real character of the act. I can see no difference in principle between a suit by the owner of a patent against an infringer to recover the profits he has made and a suit by the owner of land or of a mine against a wrongdoer to recover the value of timber or ore taken. I cannot assent to the proposition that the profits actually made by an infringer, for which recovery is sought by a bill in equity, are the same as damages in an action of libel, slander, diversion of a watercourse, trespass in breaking up meadow or pasture land, and similar actions of tort. The former are the actual direct pecuniary benefits, capable of definite measurement, acquired by the wrongdoer; the latter are primarily the loss suffered by the injured party, where the wrongdoer realizes no pecuniary benefits, or only such as are indirect, indefinite, or rest in speculation, compromise or arbitrary adjustment. I am of opinion that the cause of action survives and the motion must be dismissed."—Bradstreet's.

Echo in Large Halls.

The British Architect says that the acoustics of the banqueting hall in the Glasgow Municipal Building are defective, so that, as it is reported, "the most practiced speaker cannot make himself heard over more than one-half its area." At the request of the city authorities, the city engineer held a consultation with a member of the Glasgow Institute of Architects, to determine what should be done to remedy the trouble.

The architect thought that it would be necessary to make important structural alterations in the room. The authorities said that they could not entertain this idea, and the city engineer tried his hand at a suggestion. He discovered that the ceiling was covered with slabs of fibrous plaster, suspended from timber framing, and that there was a hollow space under the platform. This construction, in his opinion, gave the ceiling the character of a drum, and he advised lining the back of the plaster slabs with silicate cotton. For a similar reason, he advised filling up the space under the platform. These suggestions have been carried out, and we are told that the acoustic quality of the room has been perceptibly improved. It seems strange that a room with a resonant ceiling should be acoustically bad, a vibrating ceiling hung in this way usually improving the acoustics, by its property of conducting sound, without reflecting it; but there were probably serious defects of proportion in the room, which might be sufficient to produce echo and noise which the resonant ceiling could not overcome.

Whether lining the ceiling with slag cotton would improve the matter appears to us extremely doubtful. The resonance of the ceiling would unquestionably be advantageous. Its tendency to produce an echo, which is a totally different thing, would be, so far as it existed, injurious. To line the ceiling with a mass of fibers would check such resonance as it might possess, and would not, so far as we can see, diminish in the least any disposition that it might have to produce an echo. In the same way, the hollow space under the platform would be, and was probably intended to be, acoustically valuable, through the reinforcement which the vibrating mass of air in it, or the elastic walls inclosing it, would give to the speaker's voice; and to fill it up with dead material seems to us a very strange proceeding. What city engineers may think on such subjects we cannot say; but architects should keep in mind the golden rule, that resonance, such as is to be obtained by thin, elastic linings, or even by masses of air judiciously distributed, is a thing to be sought in designing rooms for hearing music, or for public speaking; while echo, such as is produced by hard, unyielding surfaces, is to be avoided as much as possible. Every architect who has ever designed a music room for a private house knows how greatly the effect of music is improved by lining the walls of the room, and if possible, the ceiling, with thin wooden paneling; and every layman who has ever bought a piano must have noticed what depth and richness is given to the tones of one played in the dealer's wareroom, by the sympathetic vibrations with which the strings of the surrounding instruments respond to the playing. For twenty centuries, at least, architects have sought in various ways to secure similar resonance in large rooms, understanding thoroughly the advantages to be derived from it. The Gewandhaus at Leipsic, reputed to be acoustically the most perfect music hall in the world, owed its quality to the fact that it was surrounded by thin partitions, set at a little distance from the main walls of the building, which, by their own elasticity, joined to that of the mass of air between them and the walls outside, provided the resonance which experience has shown to be indispensable. In the same way, La Scala Theater, at Milan, one of the largest, and acoustically the most perfect, of all European theaters, was lined throughout with thin woodwork. The ancient Greeks, to secure resonance without the use of woodwork, placed under the seats of their theaters earthen pots, with the mouth turned toward the stage, the vibrating mass of air in these serving to reinforce the sound. On the other hand, rooms in fireproof buildings, surrounded on all sides by hard, rigid masses of masonry, are very apt to be acoustically bad. Even where the large rooms, by careful study of their proportions, are successful, the smaller rooms, which cannot be so proportioned, are in such buildings almost always intolerably noisy. So far as the Glasgow banqueting hall is concerned, it is, of course, impossible to say what may be the cause of the trouble; but we venture to predict that checking whatever resonance the ceiling and the space under the platform may possess, will do little to ameliorate it.—Amer. Architect.



THE UNITED STATES BATTLE SHIP INDIANA.

The Fireless Locomotive.

On the line of railway from the heart of the city of Marseilles to the necropolis in the quarter of St. Pierre, 1·86 miles long, 2,394 feet of which is a tunnel, fireless locomotives are employed. These consist of a cylindrical receiver charged with warm water at a maximum pressure of 227·5 pounds per square inch. At the end of a run, says the Railroad Gazette, this drops to from 43 pounds to 71 pounds. The water is then reheated to 203° C., corresponding to 227·5 pounds pressure by steam from the generators at the central station. The cylindrical warm water receiver is 10 feet by 3·8 feet, holding 550 gallons and about 21 cubic feet of steam. The steam from the generators is equally distributed throughout the warm water by means of properly arranged pipes. It is condensed after being used in the cylinders in a condenser over the receiver consisting of 1,154 tubes, representing a cooling surface of 538 square feet.

THE largest bell in Japan, that in the temple at Kioto, is twenty-four feet high and sixteen feet in diameter across the rim.

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A MODEL ELECTRIC RAILWAY PLANT.

(Continued from first page.)

with the fire banked, and there are also two additional reserve boilers, so that there are in all six boilers which are rated at 160 horse power each.

With the crank shaft of each engine is directly connected a Westinghouse dynamo, having an armature 4 feet in diameter, with a capacity of 450 amperes at 500 volts. The dynamos are compound wound, and are connected with each other by an equalizing conductor to check any tendency of one dynamo to run as a motor by the current from the other.

Fig. 4 shows the arrangement of the dynamos, connections, switches and ampere meters at the power house. Only dynamos 1 and 2, which are supposed to be in active operation, are here represented. A represents the positive main conductor and A′ the negative, while E E are the equalizing conductors from the two dynamos, the positive and negative conductors being designated by the usual signs + and —. The positive and negative conductors of dynamo 2 lead to the switch, B, and connection is made by this switch with the conductor, C, which connects with the main conductor through the ampere meter, D. The positive conductor from the dynamo is also connected with the main conductor by the conductor, F, through the circuit breaker, G.

The conductor, C, includes the electro-magnet, a, which controls the automatic releasing mechanism of the circuit breaker, G, so that when there is a cross or short circuit upon the line, the switch, G, is automatically released and the dynamos are thereby protected from injury. Two switches, two circuit breakers, and two ampere meters are here shown, one of each for each dynamo. The dynamos are each provided with a resistance box, H, which is connected up in the shunt circuit of the field magnet and is used to regulate the voltage in starting the dynamo. The dynamo is started with the switch, B, open, and when the required voltage has been reached the switch, B, is closed, thereby throwing the current into the main conductors, A, A′. Should the load increase so that the action is below the normal in either of the dynamos, the deficiency in the series winding of the field magnet is supplied by the equalizing conductor, E, thereby bringing the voltage up and preventing one dynamo from acting against the other.

At I, in Fig. 4, is represented a panel having switches by means of which the particular branch of the road connected with the panel may be thrown into or out of the circuit. Each branch of the road has such a panel in the power station.

The trolley wire, T, is connected with the positive conductor at the power station, and the rails are connected with the negative conductor at the power station. To insure continuity of the return conductor, a wire cable usually extends under ground to the power station and is connected with each rail. At the power station the rails are connected with the main conductor by a cable, as shown in Fig. 5, the flange soldered to the end of the cable being clamped to the rail web by bolts. A lead plate is interposed between the flange and the rail to make the joint watertight, thereby obviating electrolytic action in the joint itself, and thus preventing corrosion. The trolley wire is suspended above the center of the track by a cross wire supported at either end by a small windlass in the end of a curved arm pivoted in a hood clamped to the trolley pole, as shown in Figs. 6 and 9. The curved arm is carefully insulated by a bushing and washers of insulating material. The cross wire which supports the trolley wire is provided with an insulator by which the trolley wire is suspended. This insulator is in the form of an inverted cup, as shown in Fig. 7, with a central aperture in which is inserted a screw covered with insulating material, as shown at 1. This screw is held in place by a screw cap, as shown in the engraving. On the lower end of the screw is placed a cross arm, having several hooks. A folded and perforated piece of metal is placed around the trolley wire and on the hooks projecting from the cross arm, and a long, narrow key is driven in between the cross arm and the trolley wire, bringing the folded piece of metal into firm engagement with the hooks and clamping the trolley wire. The narrow key has its smaller end split, with the upper part thereof bent up against the end of the cross arm to hold the key in place. This form of trolley wire suspension is very readily applied and easily removed and repaired.

The trolley wire at the ends of different sections is supported as shown in Fig. 8, the ends being clamped to a double wedge of insulating material, the lower edge of the wedge serving to form a bridge between the two ends of the trolley wire, which allows the trolley to pass smoothly over the break. The connection between two adjacent sections of the wire is completed or broken by means of a cut-out, shown in Fig. 9. This cut-out is secured to a trolley pole in such a position as to be accessible to linemen or other authorized persons, so that should anything occur on one section of the road which requires it to be cut out, the section may be rendered "dead" electrically, by swinging out the arm of the cut-out.

An insulator which is inserted in the wires where the circuit is to be interrupted, and for connecting conductors with their supports, is shown in Fig. 10. This insulator consists of two parts, one formed of a rod having an eye on one end and a button on the other, and another rod having an eye upon one and a skeleton socket upon the other, the button of one part being inserted in the skeleton socket of the other part without electrical contact, the socket being filled and enveloped with insulating material as shown.

This road, which was organized in 1860, was equipped electrically in the summer of 1894. Since January 1, 1895, the current has been on continuously, there having been no shut-down during the operating hours since starting October 15, 1894. The speed of the cars is limited by city ordinance to 10 miles per hour within a mile of the City Hall and 12 miles per hour beyond that distance. The cost of fuel for operating the road is $0·0045 per car mile.

For the courtesy which enabled us to procure the information here presented we are indebted to H. S.

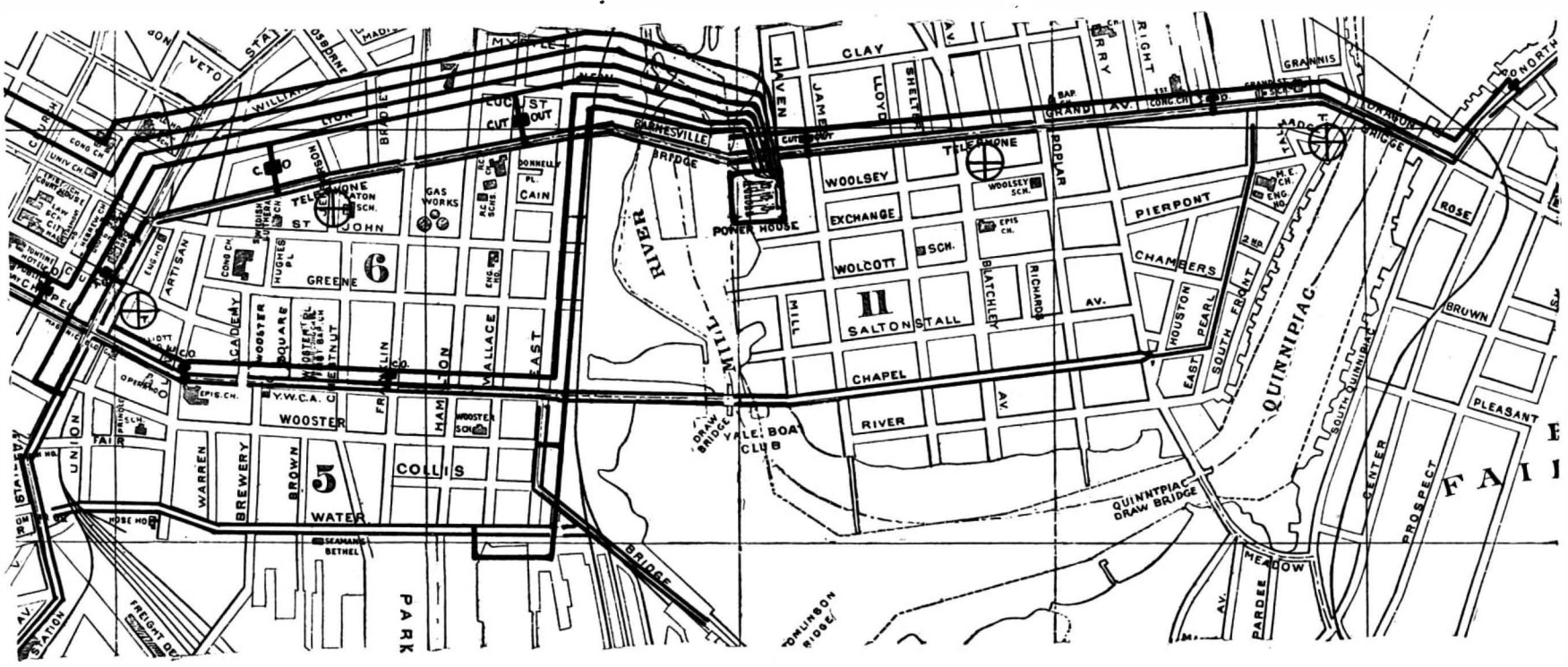

Fig. 3.—BRANCHES OF THE ROAD.

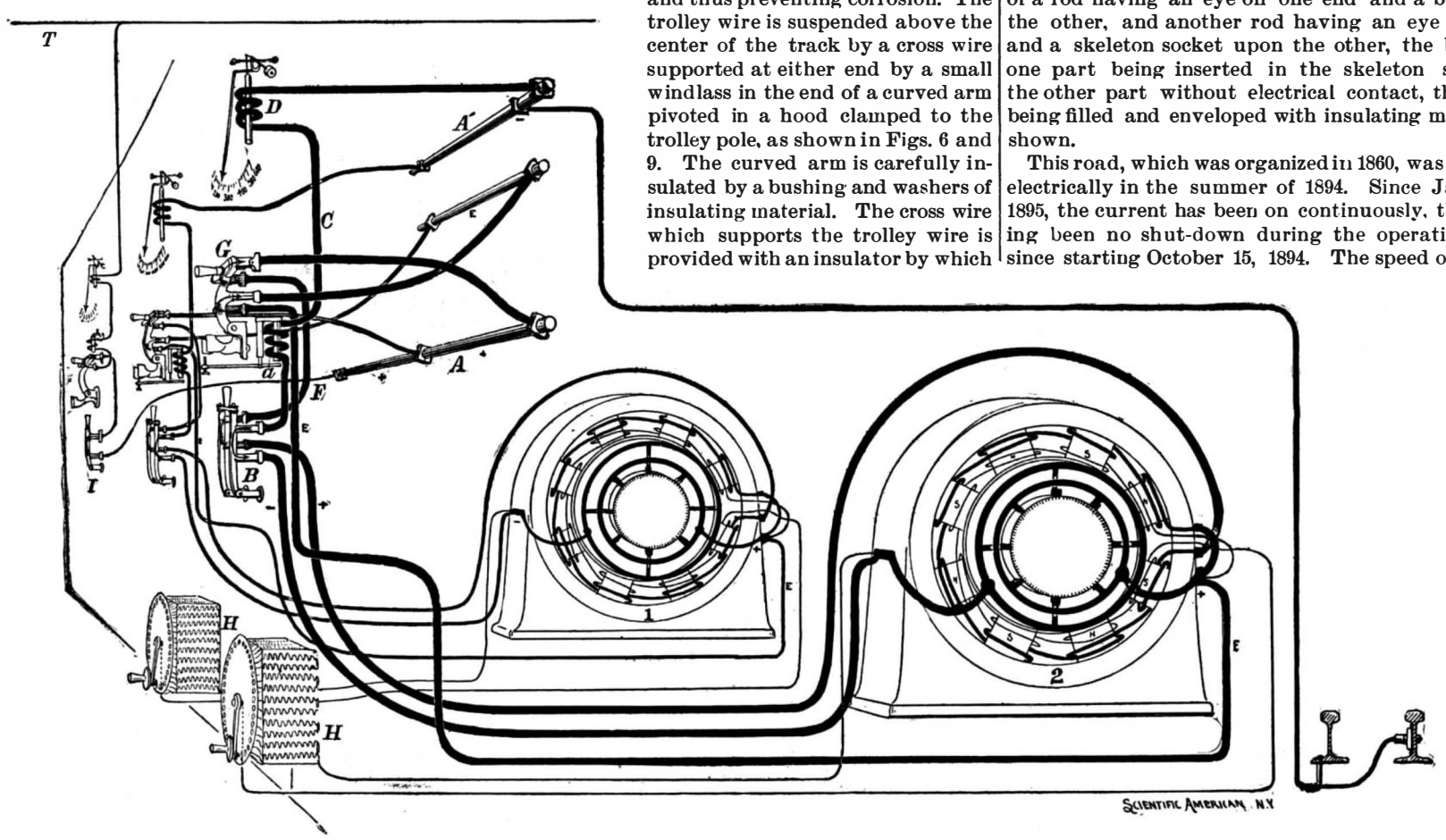

Fig. 4.—DIAGRAM OF DYNAMOS AND CONNECTIONS OF POWER HOUSE.

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Parmlee, president of the company. We have reserved our description of the cars, the motors, and the wiring and operating of the cars for a future article.

Action of the Rain.

The rain falling on the rocks sinks into every crack and crevice, carrying with it into these fissures surface material which has been degraded by the weather, and thus affording a matrix sufficient to start the growth of vegetation, and afterward to maintain the plants. The fibers and roots of these plants, bushes, and trees thus brought into life, growing and expanding, act as wedges to split up the surface of the rock and to commence the process of wearing away. From this quality of destruction a large class of plants derive the name of Saxifrages, or rock breakers, from their roots penetrating into the minute fissures in search of water, and so assisting in the process of disintegration. In winter the water collected in the hollows and crevices becomes frozen, and expanding as it changes into ice, acts like a charge of blasting material in breaking up the rocks. The pieces thus detached become further disintegrated by frost and weather, and, being rolled over and over and rubbed against each other as they are carried away down the mountain currents, are ground gradually smaller and smaller, till from fragments of rocks they become bowlders, then pebbles, and finally sand. As the mountain stream merges into the river the pebbles and coarse sand continue to be rolled along the bottom of the channel, while the argillaceous particles and salts become mingled with the water, and flow on with it either in suspension or solution.—Longman's.

Why We Like Dogs.

And why do people keep such lots of dogs themselves and go in such numbers to see other people's dogs? queries Popular Science News, and then proceeds to answer. Because the dog is at once the sincerest flatterer and the most successful cheerer that the human race ever had. A good dog always gives us the feeling that we men and women are a sort of gods. No other animal does anything of the kind. The cat treats us as an inferior, and the horse will treat us as a dear friend, not a divinity. The dog, moreover, imparts something of his peculiar gayety to us in a way that is irresistible. He mingles his suggestion of gayety with his flattery; for he not only leaves his dinner untasted to walk with us, but the mere fact that we are apparently giving ourselves the pleasure of a walk raises him into such a delirium of delight that the sight of it puts all our dumps and blues to such reproach that we shake them off in very shame. And when we don't walk, but sit moodily at home, the dog curls up lovingly at our feet, and looks up now and then into our eyes, and "glides into our darker musings with a mild and healing sympathy." Yes; there is solid reason for the fondness of men for dogs, and it will never come to an end until either men or dogs become very different beings from what they are now.

Spontaneous Combustion.

Many substances take fire very easily. Greasy rags, cotton waste, etc., are readily self-ignitible. Some foreign manufacturer has instituted experiments on the self-ignition of cotton waste, and the results were very interesting. A handful of cotton waste was dipped into linseed oil, squeezed out, placed in a wooden box, and the temperature observed by means of a thermometer introduced into the box. The temperature surrounding the box was kept at 70 degrees C. Soon after the temperature in the box rose to 173 degrees C., and smoke issued therefrom. When opened so as to admit air a flame burst out at once. A box, from which the air was perfectly excluded, consumed after five or six hours. In another experiment, in which the cotton waste was saturated with rapeseed oil, the box burned after ten hours. With an outer air temperature of 56 degrees C., gallipoli oil caused the spontaneous combustion of cotton wrapped in paper; castor oil required twenty-four hours; sperm oil, four hours; train oil, two hours, for a lively combustion.

In view of these conclusive practical results, it will readily become apparent to the thoughtful person that it is extremely dangerous to allow greasy or oily rags or waste to lie around the paint shop. Indeed, it is wrong to throw such matter upon the floor at all, because it is apt to be forgotten and left lying there for some time. The safer and much better plan is to provide a galvanized iron receptacle, having a cover, in which to throw all discarded waste at once, so that even should ignition ensue, the contents would simply burn without damage to surroundings. If it be urged that one cannot take the time and trouble to throw such waste matter at once into the can, let us remember that the very habit of being careful in this matter will tend to making us careful in other and, perhaps, all things. Time spent in doing such little things is not thrown away; nothing can be gained by first littering the floor and then sweeping the litter up.

There are dry substances that sometimes self-ignite. There is the well known example of lampblack, though it is said that the presence of small quantities of oil, which is found in the black coming from the first condensers at the factory, is the cause of the spontaneous combustion to which it is liable. Still, even the driest black may self ignite. Instances are recorded where casks of lampblack have been found almost red hot after standing some time. Prussian blue is another pigment very liable to self-combustion in the dry state, but more particularly in the preparation at the factory. Then it is extremely dangerous, and the utmost caution must be exercised, not only to prevent its bursting into flame, but to arrange matters so that in case a fire does break out it shall be confined to small limits. Outside of the factory we have heard of no difficulty attending Prussian blue in this way; of course, it is usually ground in a medium that prevents this, the dry blue being more rarely employed.

The liability of certain dry matters to explode under certain conditions is well known. Prussian blue will burst into flame because of its chemical nature; lampblack, because, usually, of the oil present; while such dry matters as flour, coal dust, and other fine organic dust, explode when certain outside causes are present. Professor Tobin demonstrated before the Kentucky Millers' Association this fact, and further showed that dampness destroyed the explosive tendency. Live steam was recommended as a preventive, by damping the air of the mill. The same would apply to the air in a woodworking factory, where it is full of dry dust. Herr Baehr, of Dresden, found that leather belts, used in mills, are rapid generators of electricity, and that this would fire dry dust and cause explosions. Professor Pepper put some fine flour in a small box, fitting the top with fine wire netting, shook the box and caused the finer dust to come in contact with a flame, like that made with a lighted stick. Under the right conditions, the experiment will result in a large flame, resembling that made by burning of loose gunpowder.

To make combustion possible, oxygen must always be present. There must be air present. The greasy rags would not take fire of themselves if kept from the air; hence, in keeping them in a tightly covered iron can, the probability of combustion is reduced, and possible combustion made of no account. It is well to remember this fact. Liquid kerosene oil never explodes. Plunge a candle flame into a gasometer of pure coal gas and it will go out as it would if plunged into water; but mix air with the gas and the result will be much different. Lamps only explode from mixed air and oil vapor. Flour dust or fine wood dust, when mixed with air, will ignite like gunpowder. In a heap no trouble ensues.—The Hub.

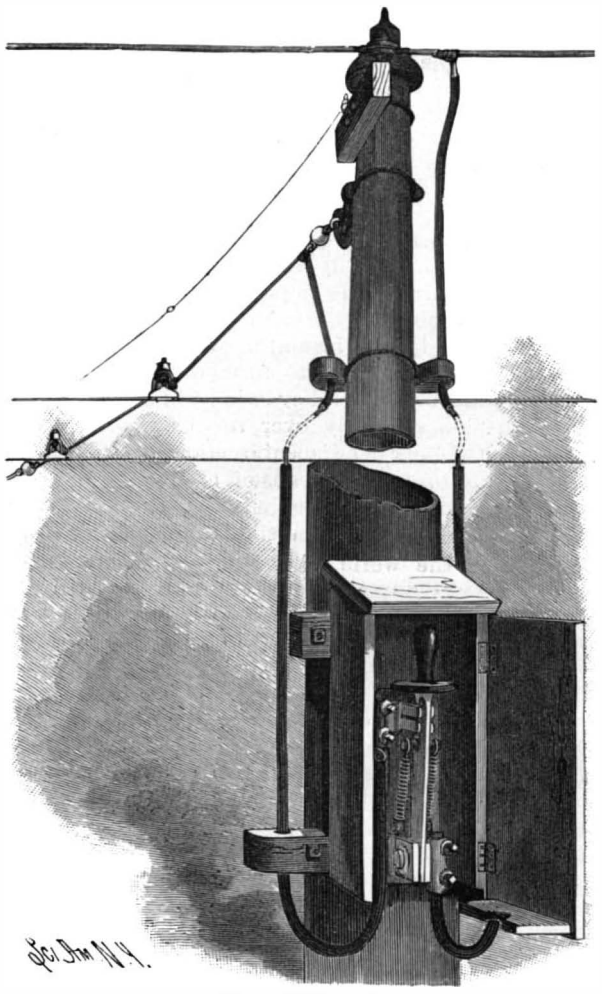

Fig. 9.—CUT-OUT

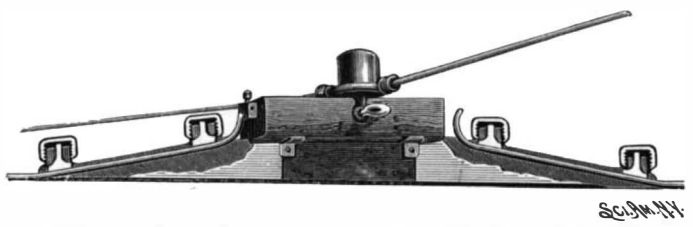

Fig. 8.—WIRE SUPPORT AT THE ENDS OF ADJACENT SECTIONS.

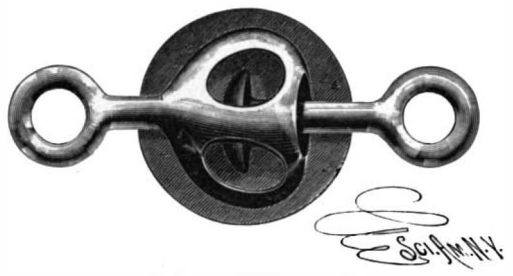

Fig. 10.—INSULATOR.

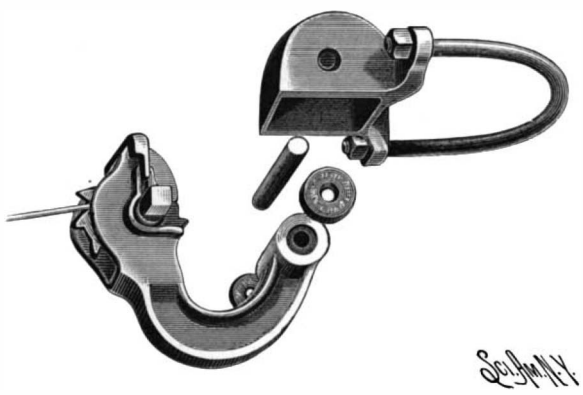

Fig. 6.—WINDLASS AND BRACKET FOR CROSS WIRE.

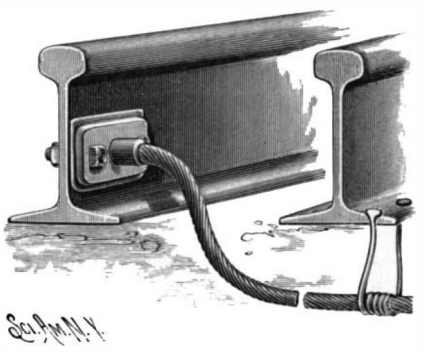

Fig. 5.—RAIL CONNECTIONS.

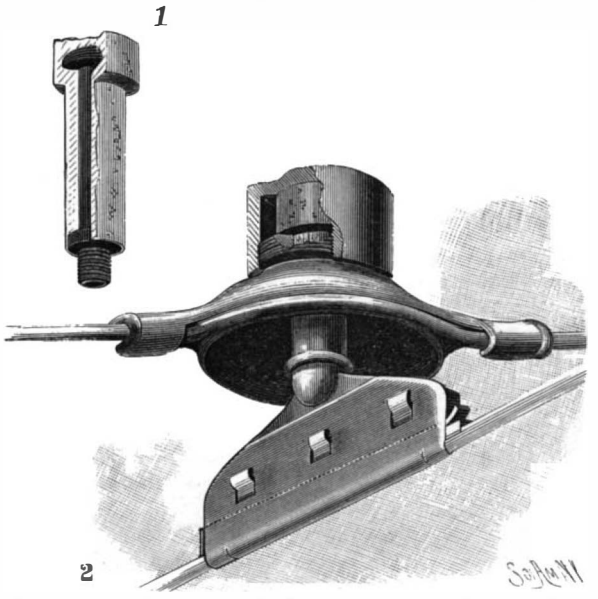

Fig. 7.—TROLLEY WIRE SUPPORT AND INSULATOR.

FAIR HAVEN AND WESTVILLE RAILROAD.

Walking Backward Cure for Headache.

An apostle of physical culture says that an excellent and never-failing cure for nervous headache is the simple act of walking backward. Ten minutes is as long as is usually necessary to promenade. It sometimes, however, requires more than ten minutes to walk at all, if one is very "nervous." But it is not understood that it is necessary to walk a chalkline. Any kind of walking will do, provided it is backward. It is well to get in a long, narrow room, where the windows are high, and walk very slowly, placing first the ball of the foot on the floor, and then the heel. Besides curing the headache, this exercise promotes a graceful carriage. A half hour's walk backward every day will do wonders toward producing a graceful gait.—Medical Record.

THE fast run which was made on the New York Central September 24, 65·96 miles an hour for 147·84 miles, was beaten the very next day, another special train carrying newspapers having run from Albany to Syracuse, 147·84 miles in 130 minutes, equal to 68 23 miles an hour. Nothing is said in the reports about the amount of time occupied in running through the street approaching Syracuse. The weight of the two cars of this train is given as 167,107 pounds.

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Old Rubber Shoes.

The business of gathering waste rubber is chiefly confined, so far, to cast-off foot-wear. The methods of reclaiming rubber were first applied to scrap of this class, and the organized channels through which 18,000 tons of scrap annually trickle from the hands of country peddlers into larger streams, until the rubber reclaiming factories receive it in carload lots, have all been planned for the collection of old shoes. The price of old shoes at the point where they first become a merchantable commodity it would be hard to say. In many rural districts rubber shoes are collected in the spring months, together with rags and other waste, by peripatetic merchants whose stock in trade, whether in a pack or a little wagon, consists of tinware and cheap trinkets, intended for exchange at the farm house for the contents of the scrap bag. No cash changes hands in these transactions. When the peddler returns to his starting point he turns over his collections to the village merchant for more tinware, with perhaps a little cash, and goes out over a new route in quest of rags. The peddler may be in business on his own account, or in the employment of the village trader, but in either case the latter has a chance to make a profit on the collections of scrap, which are shipped from time to time to a city dealer. The latter will offer his rubber stock, whenever it reaches good proportions, to a rubber reclaiming mill. In shipments from the West probably 5 per cent of the whole will consist of rubber scrap, 25 per cent of metal, and the rest of paper stock and rags. There is no one handling rubber shoes alone, however. Whoever buys the country merchants' collections must take the whole lot. But the rubber is the most prized part, in proportion to its extent, since the trade in rags for paper stock has been greatly depressed in recent years, while rubber scrap has gone upward in price, with the increased number of rubber reclaiming factories and the consequent competition in the business. It may be noted that, when old shoes first became a merchantable article, the price paid for them by manufacturers was 1 cent per pound, while the quotations have since averaged 5 cents per pound for months at a time.

The trade in rubber scrap is now most thoroughly organized in the West and Northwest. In the Southern States, where little snow falls, the consumption of rubber shoes is not sufficient to form a basis for a trade in old shoes. Even in New York City the use of rubbers is not large enough, in proportion to the population, to make the trade in scrap of importance. The rubber reclaiming works formerly received considerable shipments from Canada, but that was before the establishment of factories in the Dominion for working up old shoes. Of the rubber scrap imported the larger share comes from Russia. The imported scrap is not so desirable, however, as what is gathered at home. In spite of the good consumption of rubber foot wear in New England, there are no dealers in scrap there in a position of commanding importance. This is due in part to the existence of near-by factories which buy directly from the smaller dealers. In the West the principal center of the trade is Chicago.—India Rubber World.

The Trend of Electrical Development.

In years gone by, and not so many years at that, almost the entire energy of investigators into electrical science was devoted to the improvement of the primary battery. There was indeed reason for this in that its efficiency was comparable to that of the steam engine and far in advance of any known methods of obtaining available energy from fuel. Its drawbacks, however, were many. The fuel, which was zinc, and the atmosphere in which it was consumed, which was the acid or saline solution, were far more expensive than coal and atmospheric oxygen, and the care required to keep the batteries in working order was excessive and burdensome. It seemed very possible, however, to so improve the details of the battery as to render its care less irksome, and invention turned its attention with considerable success in that direction. How to produce a cheaper fuel and atmosphere, however, was not so apparent, and practically no progress was made in that direction. With the advent of dynamo-electric machines producing electricity from ordinary coal, and atmospheric oxygen through the intermediary of the boiler and steam engine, notwithstanding an inefficiency of over 90 per cent as against about 20, the primary battery came into disfavor and those who continued the investigation of the great problem connected with it became themselves the subject of obloquy and derision.

The dynamo-electric machine has now been developed so nearly to its theoretical limit as to leave no reasonable expectation of any further advances in the way of efficiency.

In the meantime electro-chemical science has been advancing with giant strides, and many metallurgical operations which before were dependent directly upon the combustion of coal are now performed more quickly and more cheaply by the intervention of the boiler, engine and dynamo.

It is the dynamo itself that has rendered this possible, and the next step will be that the dynamo by familiarizing us with electro-chemical processes will enable us to produce electricity itself by electro-chemical processes.

There seems to be no question that galvanism is to be re-enthroned somewhere in the near future. It will not entirely supplant dynamo electricity, however, for the latter will always have its field of usefulness, and there will always doubtless be conditions where, even with its 90 per cent inefficiency, it will be cheaper than the battery method, but it is not to continue to hold undisputed sway as it has during the past decade and more.

It is idle to suppose that any method can be devised of consuming zinc to compete with coal. The economic possibilities of batteries consuming zinc have been almost as nearly reached as have those of the dynamo, and no further progress can reasonably be expected in this direction. Nor is it reasonable to expect that electricity will be generated by chemical means directly from coal.

The fuel for our boilers requires some preparation before it can be economically employed there, and it is to be expected that it will require some special preparation to adapt it to the direct production of electricity. Under our boilers the admission of atmospheric oxygen has to be carefully regulated, else the results obtained are unsatisfactory. It is not unreasonable, then, to expect that the method of burning our fuel for direct electrical production will have to be carefully considered.

The direct production of electricity from fuel does not therefore mean the burning of an unprepared fuel in an uncontrolled atmosphere, but means a proper preparation of both, and their especial adaptation, so that the latent energy may become manifest in the electrical instead of the heat form. These are all problems for the electro-chemist, and they are problems that are being attacked by so many vigorous thinkers that their solution must be in the order of things.—Electricity.

The Telephone Newspaper.

The telephone newspaper organized at Pesth, Hungary, has now been working successfully for two years. It is the only newspaper of the kind in the world. It is called the Telephone Hirnondo, or Herald, costs 2 cents, like a printed paper, and is valuable to persons who are unable or too lazy to use their eyes or who cannot read. It has 6,000 subscribers, who receive the news as they would ordinary telephone messages. A special wire 168 miles long runs along the windows of the houses of subscribers, which are connected with the main line by separate wires and special apparatus which prevents the blocking of the system by an accident at one of the stations. Within the houses long, flexible wires make it possible to carry the receiver to the bed or any other part of the room.

The news is not delivered as it happens to come in, but is carefully edited and arranged according to a printed schedule, so that a subscriber at any time knows what part of the paper he is going to hear. It begins with the night telegrams from all parts of Europe. Then comes the calendar of events for the day, with the city news and the lists of strangers at the hotels. After that follow articles on music, art, and literature. The staff is organized like that of any other newspaper, and is only on duty from 7:30 in the morning till 9:30 at night. After the copy has passed through the editor's hands, for the paper is subject to the same restrictions as ordinary newspapers and is liable for its communications, it is given to the "speakers." These are ten men with strong voices and clear enunciation, who work in shifts of two at a time and talk the news through the telephone. There are 28 editions uttered a day. Additions to the first edition are announced as news items.

To fill up the time when no news is coming in, the subscribers are entertained with vocal and instrumental concerts.—N. Y. Sun.

Bacteria in Mineral Waters.

Dr. P. Seidler, at a recent meeting of the Berlin Pharmaceutical Society, read a paper in which he gave the number of bacteria per cubic centimeter found in two different bottles of each of several mineral waters, as follows (Am. Drug.):

Langenschwalbacher Wienbrunnen	44–147
Hunyadi Janos	4460–6615
Niederselters	136–855
Biliner	675–3456
Harzer	7600–12450
Egerer Franzquelle	302–504
Schlesischer Obersalzbrunnen	96–406
Fachinger	2250–16700
Kissinger Rakoczy	2250–12600
Emser Kraenchen	5890–7250
Karlsbader Muehlbrunnen	3890–27216
Vichy Grand Grille	13400–14300
Wildunger	870–945
Spaa Pouhon	1137–1160
Friedrichshall	5600–5795

The waters, as a general thing, are practically free from bacteria when they emerge from the earth, but these develop rapidly through carelessness in washing the bottles, corks, etc. The author found the artificial waters, as a rule, to contain as many bacteria as the natural.

The Bank of England.

Some interesting facts about the Bank of England and its history have been gathered by the Social Economist.

It will be remembered that on January 1, 1895, this institution celebrated its second centennial anniversary. It was organized to relieve William III from the difficulties he experienced in raising funds to prosecute the war against France. William Patterson, a Scotch merchant, was the original projector of the enterprise.

"The terms of the charter were that the sum of £1,200,000 ($6,000,000) should be raised, and that the subscribers should form themselves into a corporation styled 'The Governor and Company of the Bank of England.' The bank was also to have the privilege of keeping the accounts of the public debt, paying dividends, issuing notes, etc., for which an allowance of £4,000 a year was granted. The whole of the capital was to be loaned to the government at 8 per cent. This interest, together with the £4,000 allowance, gave the bank a revenue of £100,000 per annum.

"At its very outset the bank was a servant of the government, and it has retained that character, but in somewhat diminished degree, through all the ages of its subsequent history. It is a curious fact that, although founded by a Scotchman, Scotchmen are eschewed by the bank. What the first of the race did to entail the ban upon his fellow countrymen is not recorded, but it is commonly said in London that three descriptions of persons are excluded in practice from employment at the bank—namely, Scotchmen, Jews, and Quakers."

In the basement of the bank building are barracks in which are quartered thirty soldiers daily. It has been the custom to station soldiers at the bank ever since the riots of June, 1780, when an attempt was made to sack the bank.

"The Bank of England first issued notes in 1695, which were for £20. The £10 notes were issued in 1759 and the £5 notes in 1793. At one time during the early years of the present century notes of £1 and £2 were issued, but in 1844 they were all withdrawn from circulation, and no notes are issued for less than £5, and none higher than £1,000.

"These notes may be said to be the safest pieces of paper in the world, as under any circumstances the bank could pay with gold any one in circulation without one pound of the capital of the institution being touched. They are a legal tender everywhere in the United Kingdom, except at the bank itself, where they must be paid in gold.

"The bank started with a capital, as stated, of £1,200,000. In two years this was increased to £2,201,000. In 1710 it was again increased to £5,560,000. On June 29, 1816, it was increased to its present sum of £14,553,000, equal to about $72,700,000. No reports of the bank are made beyond the regular weekly statement.

"The Bank of England has sometimes been in difficulties. It failed in 1696, and in its earlier years it was subjected to many runs, some organized by the jealous private bankers, some the result of political causes. . . .

"The present governor of the bank and the deputy governor each receive a salary of £1,000 a year. The bank has 24 directors, each of which must hold £2,000 of stock, and who receive £500 a year compensation. There are in all 1,050 persons employed in the various departments of the institution, and their united salaries amount to about £1,400,000 a year.

"Up to 1826 it was the only joint stock bank in England, and until 1835 it remained the only joint stock bank in London. At that date the London and Westminster Bank was founded, and at the same time forty other joint stock banks were established in Great Britain. . . .

"The Bank of England is not only the banker of the government, but it is also the bankers' bank. All other banks keep their bullion reserves at the Bank of England, and this is one fact that gives the establishment its special importance as the center of England's monetary system. This reserve is seldom allowed to fall below £10,000,000, a fair average being from £10,000,000 to £14,000,000. The daily transactions of this institution sometimes run as high as £6,500,000.

"The number of persons receiving dividends is nearly 284,000. Nearly £25,000,000 ($124,000,000) are annually paid out by the bank as dividends on stock annuities reaching the enormous sum of £775,000,000 or say $3,873,000,000.

"During the year 1892 the stock of the bank sold as high as £344 per share and as low as £325. The highest dividend ever paid was in 1697, 27½ per cent, and the lowest during the years 1753-63, 4½ per cent. For twenty years the dividend has averaged about 10 per cent."

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Pipe Line for Sewerage at Reading, Pa.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. William H. Dechant read a paper fully describing the method of constructing the submerged pipe line across the Schuylkill River at Reading. The width in this particular part of the river along the pipe line is about 400 feet and the deepest part about 10 feet below extreme low water, the average depth being about 8 feet.

A 30 inch cast iron pipe was used, weighing a little over two net tons per length of 12 feet. The channel was excavated across the bed of the river to lay the pipe in, so that the bottom of it would be about 2 feet below the ordinary river bottom. Previous soundings with a pointed steel rod had shown the bed rock to be far enough down to allow the proper depth of trench, although the rock was scraped at several points in the dredging. The dredging machines were kept exactly on the line by means of a No. 8 wire stretched across the river 10 feet north of the center line. Tags were placed on the wire at a distance apart equal to the length of each pipe section, with the proper depth below the surface for each joint marked upon them.

The line of pipe was laid by first joining the sections suspended from trestle work across the river by means of long screw rods, attached to each pipe, so that the entire length occupied the same position that it was to have in the bottom of the trench. The whole thing was then lowered uniformly by a man at each screw, keeping time in the turning.

A flat scow was arranged to carry each section of pipe from the shore to the trestle work with a trunnion in its center, so that the pipe could be turned around into almost any position to anchor it along the line of trestles. The trunnion was so made that the operator could move the pipe some distance endwise also.

The methods of setting the trestle work, suspending the sections of pipe from the screw rods, making the joints and lowering the pipe were described in detail. Three days were occupied in the erection of the trestles and four more in getting the pipe ready for lowering. The lowering occupied altogether about five hours.

Snakes and Fishes.

One of those quiet workers connected with the Museum of Comparative Zoology, at Cambridge, who for years has been conducting most interesting researches, is Dr. Samuel Garman, whose name very rarely appears in the newspapers, yet whose work is of such quality that it has gained him the highest honors from institutions abroad.

Dr. Garman is a Western man, and has been on the staff of the Museum for thirty years or more. He was with the elder Agassiz in South America and elsewhere, and since that time he has accompanied or led a number of others of the expeditions of this institution. At the time that Stanley made his celebrated march across Africa, Dr. Garman was just about to head a small party for exploration in the Dark Continent, but the excitement among the natives which followed the former expedition made it seem judicious to give the latter up.

Dr. Garman's particular field in the animal kingdom is that of the snakes and other reptiles and fishes. He can tell tales from his own experience which would put to blush the most imaginative of the stories of the authors of to-day, and is well prepared to hold his own when the conversation takes on a fishy strain, even in the presence of the oldest and most fortunate of anglers.

He is on intimate terms with all the snakes, handles them without fear, keeps them about his laboratory (in cages, however) for purposes of study, and has discovered no end of curious things about them, all of which are faithfully stored in great volumes of publications, where the public has hardly a chance to get at them.

A rattlesnake, a native of Missouri, has boarded with him for upward of two years. It is a brightly marked beast, more vividly painted than are our native rattlers of Blue Hill or Mount Tom. It is large and well filled out and has a keen eye for the stranger, whose approach to his cage seldom fails to call forth a shrill alarm. It is active, but naturally is somewhat cramped in its comparatively small quarters. It has made a few excursions, however; one a while ago to a meeting of the Boston Scientific Society, where he was let loose to crawl about the floor, to show his curious oblique method of progression. Dr. Garman does not like, however, to take him into strange places, since a rat hole might afford him a safe retreat, and the chances of recovery in good condition would be very slight.

This beast seems to know his captor and makes no effort to strike him with his fangs, allowing himself to be handled with what seems like carelessness, but which is the skill born of long experience. He is more sedate than one of the younger specimens which was here a few years ago, which, while appreciating the warmth of Dr. Garman's hand and forming a coil upon it, was greatly incensed at visitors, and testified to this by vigorous rattling.

This Missouri specimen has yielded to science quite a number of interesting facts. He has been in his cage so long that it has been possible to follow step by step a number of his changes. It is known positively that he loses his skin twice a year, and that he adds a rattle for every skin. Instead of losing the rattles as he does his skin, they are retained by the closing of the inner end of the old rattle over the knob of the new one, and accidents excepted, the snake bears with him this record of his age. But accidents will happen. Through friction or for some other reason the horn which forms the rattle may become thin, and in such case, the catching of the rattle in some obstruction would tear it away. In this very snake some holes have now appeared near the base of the first loose rattle, and were the animal free in the woods, there is but little doubt that he might soon become a snake with only a single rattle on his tail.

As to snake bites, Dr. Garman is in position to speak authoritatively. He has had a great deal of experience, and has been bitten by all sorts of snakes. Most of them leave simply two little holes not more troublesome than the bite of a cat. The rattlesnake bite is quite different, and requires immediate attention. The part bitten is relieved of the poison as much as possible by sucking, while the member is constricted by an impromptu tourniquet, which permits the poison-bearing blood to reach the heart only in mere driblets. And nature does the rest. There is a possibility that if the tooth should penetrate into one of the larger blood vessels, this treatment or any other might not be successful, but the chances are in its favor.

One may very readily inquire how it is that such a skillful snake catcher could permit himself to be bitten at all, but this is easily explained. In the instances in which it has occurred the bite was not from the snake that was caught, but from a mate which had not been noticed, but which, disturbed by the capture of its companion, struck at the common enemy.

But to turn a moment to Dr. Garman's investigation among the fishes, there are a number of points of general interest whose elucidation has been due to his persistent research. One of these concerned the artificial hatching of trout. It was found at the fisheries that a very large number of the fry were joined, two and two, like Siamese twins, and so large a number as to be very noticeable. This was quite a puzzle to naturalists for a long time, for there was no evidence of its occurring in the brooks and natural hatcheries, and yet all the features of the hatching seemed precisely the same.

The female was customarily relieved of her eggs by gentle pressure, and these eggs were made fertile in the natural way, but nevertheless there was the peculiarity of Siamese twins, triplets, and even quadruplets. Why was it so?

Dr. Garman came at the solution a number of years ago, and his notion has since been generally accepted. The perfect egg has a solid shell all about it, one point excepted, where the fertilizing particles are to enter into the egg and give it life. The natural depositing of eggs by the female was an operation of some little time, and every egg had an opportunity to become perfect, and had only the one vulnerable point. With the artificial process, however, the eggs were discharged all at once, and naturally in different stages of completeness. In the less perfect ones, defects in the shell allowed vivifying particles to enter at two or more different places, and two or more embryos began their growth upon the same nucleus, which with later development became the curious twins.

But there is another discovery by Dr. Garman, a most remarkable one, which sounds like romance, that some fishes come in rights and lefts, for all the world like a pair of slippers, neither complete without one of the opposite kind. This is a very new discovery, and it is very doubtful whether even all the fish men in the different museums have yet read about it, for the proof of it finds place in a volume of Proceedings of the Museum in Cambridge, hardly two months published.

The poet Moore in his researches in Persian lore, made one day a great find, and has translated for us a poetical description of

> Sweet birds that fly together,
> With feather always touching feather,
> Linked by a hook and eye.

These wonderful birds lacked each of them a wing, and so were not complete until they could find mates that lacked an opposite wing. This is a pretty fiction, and of course outside the bounds of possibility. But Nature is inventive even beyond the dreams of man, it is not possible to invent a form so curious that some one in a congress of naturalists would not be able to give the name of the organism that looks like it. The ridiculous drawings of great horrid fishes which the Chinese make for us, which surely cannot resemble anything on earth, in the seas or in the waters under the earth? But, they do; and if one is permitted to examine the priceless pictures made by the hand of the elder Agassiz himself, which are preserved in one of the attics of the Museum, he will find that the great naturalist is quite in accord with the Celestial in the queer shapes which he has depicted.

These queer fishes which Dr. Garman has studied belong to the genus Anableps, the haunts of which are in warm waters from South to Central America. There are several odd things about them. In the first place they bring forth their young alive instead of depositing eggs in suitable places and leaving the rest of it to good fortune. In the second place they have a very curious eye; it is the exact counterpart of the divided spectacle lens which is so commonly in use, one half for far sight and the other for reading. This is literally true, the eyeball of the fish is divided into two portions by a black curtain, so that there is an upper half eye and a lower half eye. The division begins very early in the development of the young fish, there being first a little encroachment of the black border into the eyeball, and, having entered it, finally stretches clear across horizontally. So the fish has two half eyes in each socket.

Anableps is a fish of rather large horizontal proportions, and as he swims, his head lies partly out of the water, the water line being in fact just at the division in his eye. The upper eye he uses for vision through the air, seeking for food in the vegetables floating on the surface. The lower half of his eye he uses for vision through the water, and thus gets timely warning of the approach of his enemies.

One would think these oddities quite enough for a comparatively insignificant little fish, a few inches in length, and not making much figure in society, but it is this same genus which exhibits rights and lefts. The proof of this peculiarity depends upon close scrutiny and the dissection of the animal, but its anatomy leaves no possible question in the matter.

A right Anableps is doomed to wander about in lonesomeness through the seas filled with Anableps of his own pattern, and can never be happy until some opposite example, opposite in sex as well as one-sidedness, is found to share his home. And here comes in a most curious bit of statistics. Of the specimens which it has been possible for Dr. Garman to inspect, a number sufficiently large to be tolerably representative, three-fifths of the males are rights and two-fifths are lefts, while of the females, three-fifths are lefts and two-fifths rights. The three-fifths of the males that are rights will find in three-fifths of the females that are lefts most congenial companions, while the two-fifths males that are lefts will find a mate for each in an equal proportion of females that are rights. This balance in nature is by no means the least remarkable feature in the story.—Boston Commonwealth.

How Lobsters Are Hatched.

"During the season that has just closed we have hatched 75,000,000 lobsters, 45,000.000 codfish, and 6,000,000 flatfish or flounders," stated Superintendent John Maxwell, of the United States fish hatchery station at Wood's Holl. "The lobster eggs are put into glass jars, each of which holds 75 ounces; they are placed on a table very similar to the one used to hold the cod-hatching boxes. There are two glass tubes which enter the jars at the top, which is closed with a porcelain cap. One of these tubes goes to within a fraction of an inch of the bottom of the jar, while the other enters only a short distance from the top, and just above the eggs of the lobster.

"The one which goes nearly to the bottom keeps the eggs moving at a lively rate, and it is this moving about that hatches them. As soon as an egg is hatched the young lobster, swimming about, rises to the top of the jar, and by the siphon is drawn into the receiving jar, which is covered with linen scrim, which allows the water to escape when it becomes filled, and still holds the young lobster captive. The eggs are still kept stirred up by the fresh supply of water until all that are alive have been hatched and drawn into the big jar. It depends upon the temperature of the water, the same as with the cod eggs. The required temperature is 55°, and the time usually required is from two to four days. We begin to hatch the lobster eggs on April 1. Several years ago an experiment in hatching eggs received during the winter months was tried at this station. Eggs were received on December 12 and continued to be taken until January 25.

"During this period 148 lobsters were stripped, yielding 1,717,700 eggs, which were placed in the hatching jars, the temperature of the water being 45°. None of these eggs, however, began hatching until May 25 following, the water being 54°, and on the 6th and 7th of June 856,500 fry were released in local waters. The period of incubation, therefore, ranged from five and one-half to four and one half months, the loss being over 50 per cent."—Boston Globe.

SUCH is the clearness of the atmosphere in the vicinity of Arequipa, Peru, that from the observatory, 8,050 feet above the sea, a black spot one inch in diameter, placed on a white disk, has been seen on Mt. Charchani, a distance of eleven miles, through a thirteen inch telescope.

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RECENTLY PATENTED INVENTIONS.

Engineering.

EXCAVATOR. — Alexander McDonald, Cambridge, Mass. This is a machine for making ditches, canals, tunnels, etc., and comprises a swinging supporting frame, revoluble picks mounted on shafts, and an endless carrier on the frame under the picks to receive and carry away the loosened material. The material is undermined by the picks and falls by gravity into the buckets of the carrier, and the swinging frame supporting the picks and the carrier may be swung above a horizontal line, so that the material can be removed to any desired height.

Railway Appliances.

CAR FENDER.—James W. McKinnon, New York City. This is a tilting fender slidingly mounted in guides under the car, the forward end of the fender being depressed when in its outer position. When the brake is applied the fender is automatically carried out beyond the front of the car, although it may be readily disconnected from the brake mechanism and projected outward independently thereof. The fender is ordinarily carried beneath the car platform, and may be readily attached to a car without interfering with the usual fittings of an electric or cable car.

STORM CURTAIN FOR STREET CARS.—George Maust, Philadelphia, Pa. This improvement comprises an inclosure for car platforms, including standards extending from the dash to the roof, there being adjustable brackets on the standards and a stretcher carried by the brackets, while a curtain connected with the roof extends down over the stretcher. With this improvement the platform may be quickly housed in to protect its occupants from the weather, and when the curtains are not required they may be removed entirely out of the way.

Agricultural.

CULTIVATOR.— David A. Lenox and James A. Underwood, Salem, Mo. This cultivator has spring teeth adjustably attached to frames which may be moved either to the right or left to pass obstructions. The teeth are so made as to be very durable, and less liable to breakage than usual, and the depth to which the teeth enter the ground is regulated entirely by the draught, thus dispensing with lock levers and similar devices. The entire bed or body of the elevator carrying the teeth may be adjusted to compensate for any wear that the teeth may sustain.

WEED PULLER.—Frederick W. Read, Marquette, Mich. This is a simple implement, made preferably of a rod of steel, twisted to form a handle, twin shanks, and fork-like points, the tool to be worked something as an auger around the root of a plant or weed. When the tool is buried deep enough, a quick upward movement removes the weed, foliage, and surrounding earth, facilitating the cleaning of a lawn from any objectionable plant.

PEA AND CORN SHELLER.—Benjamin F. O'Kelley, of Planter, and George W. O'Kelley, Jr., of Harmony Grove, Ga. This machine comprises a separating drum with which is connected a flail wheel separated from the drum by an annular partition, while a picker wheel acts in conjunction with the flail wheel, there being a screen or sieve beneath the drum and flail wheel and independent hoppers leading to the drum and flail wheel. When the separation is made the peas or corn kernels are subjected to a blast of air to remove foreign matter, a second blast of air being delivered just prior to delivery to the receiving chute.

Miscellaneous.

MIXING APPARATUS.—Marie J. E. Laurans, Eugene J. B. Paul E. Jodelay, and Jules A. Tournel, Paris, France. This invention relates to apparatus for mixing water with an antiseptic liquid to form a disinfecting mixture, the mixture being made of uniform proportions and the pressure of the water utilized to produce the mixture or spray the disinfectant. The apparatus may be used for sprinkling streets, sidewalks, buildings, etc., and for a great variety of other purposes.

CIGARETTE MACHINE.—Domingo Perez y Buñol, Havana, Cuba. This machine fills the requisite quantity of tobacco into a receiver, and winds the wrapper around the tobacco filling. A conveying device separates and feeds the right quantity of tobacco to a receiver section, where it is compressed by a plunger, and the receiver is carried to a wrapping device, to which also a cut wrapper is brought, a finishing device tucking the wrapper ends inward when this is desired. Long cut tobacco may be used in the cigarettes made in the machine, or, by means of an accessory part, it may be made into fine cut before being fed into the receiver.

BICYCLE FRAME.—Henry and Frederick Mesinger, New York City. The principal members of this frame are made of two pieces of wood united by suitable metallic joints and clips, the frame being designed to be of great durability and lightness, while possessing ample strength. The frame conforms to the usual diamond shape, and the ends of the pieces are spread apart to form the forks for the rear wheel.

BRAKE BLOCK.—Augustus F. Schilly and Reuben Cave, Newcastle, Cal. This improvement relates to brake blocks in which the shoe is removably connected to the block, and provides means for holding the shoe securely in place or readily removing it. Two hook sections are fixed to the brake block, and one of them is hinged so that it may move toward and from the shoe and lock with it.

THILL COUPLING. — Joel Johnson, Sunny Side, Ark. This is a coupling especially adapted for buggy shafts, permitting the disconnection of the shaft or pole in a quick and convenient manner, and leaving the knuckle carried by the thill iron in position for quick coupling with the receiving members of the axle. A simple and efficient form of anti-rattler is also provided.

SEAT OR CUSHION. — Morris Strauss, New York City. This invention provides an improved construction whereby seats or cushions may be more readily upholstered, bands extending inwardly from the frame, and coiled supporting springs being connected to the bands, while there is an upholstery support on top of the springs, and coiled springs connect the lower convolutions of the supporting springs. The improved construction is applicable to seats and cushions of every description.

DOOR BELL.—Emerson C. Tibbals, Cobalt, Conn. This is a mechanical construction arranged to positively and regularly sound a bell upon releasing a push button, the latter operating a segmental gear wheel attached to a spring-pressed shaft, and a pawl and ratchet mechanism connecting the shaft with the striker, to operate the latter after the button is released. The bell preferably forms a cover or casing for the mechanism, to protect it from dust.

REAGENT FOR GOLD OR SILVER ORES.—Eloy Noriega, Mexico, Mexico. To facilitate the working of these ores, reducing the time for thorough amalgamation and effecting a saving of mercury, this invention provides for making a reagent by mixing a chloride, an acid, the sulphate of a metal, and the metal which forms the base of the sulphate, and subjecting the mixture to the action of steam until the resulting product is reduced and crystallized, the base of the chloride being stronger than that of the sulphate.

MUSIC BOX DRIVING GEAR.—Henry Langfelder, Jersey City, N. J. To drive music boxes for a considerable length of time without rewinding, this improvement provides for a segmental gear wheel in mesh with a train of gear wheels for driving the pin cylinder, the segmental gear wheel having a slotted arm and a pin engaging the slot in the arm, while a sliding bar carries the pin, and a cross bar connected with the sliding bar is adapted to compress one or more helical springs.

Designs.

WOVEN FABRICS.—James Phillips, Jr., Fitchburg, Mass. Two design patents in this class have been granted this inventor, both for fabrics with tuft-like figures raised from the body and arranged in waved and parallel lines.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

OCTOBER, 1895.—(No. 120.)

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2. Cottage at Kennebunkport, Me., recently erected for B. S. Thompson, Esq. Perspective elevation and floor plans. A very attractive residence in the English style of architecture. Mr. Henry P. Clark, Boston, architect.
3. A cottage at Flatbush, N. Y., recently erected at a cost of $4,000. Perspective elevation and floor plans. John J. Petit, architect, Brooklyn, N. Y. An attractive design.
4. An all shingled cottage at Mount Vernon, N. Y. Perspective elevation and floor plans. A neat design in the Colonial style. Mr. Louis H. Lucas, New York City, architect.
5. A suburban cottage at Flatbush, L. I, recently erected at a cost of $8,000 complete. Perspective elevation and floor plans. Messrs. Rowe & Baker, New York City, architects. An attractive design in the Colonial style.
6. A dwelling at Glenwood, Yonkers, N. Y. Perspective elevation and floor plans. Messrs. D. & J. Jardine, architects, New York City. A most unique design.
7. Three perspective views and floor plans of a residence at New Rochelle, N. Y. Architects, Messrs. Stephenson & Greene, New York City. A well treated design.
8. A Colonial residence at Mountain Station, N. J. Two perspective elevations and floor plans. Mr. H. C. Pelton, architect, New York City.
9. A house at New Haven, Conn., recently erected at a cost of $3,500 complete. Two perspective elevations and floor plans. A modern economical cottage design. Architects, Messrs. Stilson & Brown, New Haven, Conn.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
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Minerals sent for examination should be distinctly marked or labeled.

(6642) A. H. writes: A steel spring (spiral) is wound as tightly as possible and then fastened with a piece of copper wire, in such a way that if the wire were unloosened, the spring would exert power which might now be considered as stored. This spring is, however, inserted in a jar of muriatic acid, which dissolves the iron but does not affect the copper band. What becomes of this latent energy? A. The spiral spring when wound up becomes heated, because work is done upon it. If released, it does work and becomes cool. The spring may be wound and left to attain the temperature of the air. Now, if released so as to do work, it will become cooler than before; but if dissolved in acid, no such reduction of temperature will occur, because it does no work. In other words, a coiled spring, when wound up, has, properly speaking, no energy imparted to it by such winding, but only the capacity of converting a portion of its own heat energy into mechanical energy.

(6643) C. A. C. asks: How many feet per minute should milling work be fed to cutter? How fast should 3 inch milling cutter run or how many revolutions per given movement of bed? How are tangent bicycle wheels strung or trued up? A. As much depends upon the material to be milled as to speed of cutters and rate of feed, as will also the depth of the cut. There is a wide margin in the range of milling work, according to the condition of cutters, hardness of material and kind of lubrication. Ordinarily the peripheral speed of milling cutters may be for steel 36 feet or for a 3 inch mill 48 revolutions per minute, with a half inch feed per minute. For wrought iron 48 feet and 1 inch feed. Cast iron 60 feet and 1⅝ inch feed per minute. For light finishing cuts these figures may be increased by 30 per cent. Very small cutters should have less speed and large cutters of 5 or 6 inch diameter may have a greater speed than as above. It is not easy to impart instruction on the adjustment of bicycle wheel rims. The letting out and drawing in by the spoke nuts, on the proper sides, will bring the rim to its plane of revolution.

(6644) R. W. C. writes: By what branch of mathematics is the following problem solved? Also solve and explain it. A tree one hundred feet high breaks off, and hanging to the stub, the top resting upon the ground at a distance of thirty feet from the base. Required, the length of each part. A. The tree problem is solved by algebra, as follows: Let x = the height of the stump. We have: $(100-x)^2 = x^2 + (30)^2$. Solving, we find: $x = 45\frac{1}{2}$ feet (answer).

(6645) J. H. F. asks: How many volumes of gas at atmospheric pressure will one gallon of 74° Baume gasoline make when evaporated, with no admixture of air? How many volumes of air should be mixed with above gas to make proper explosive mixture for gasoline engine? What is maximum theoretical pressure of explosion of proper mixture of gasoline and air when exploded at constant volume with charge at atmospheric pressure and no loss of heat by radiation? Ditto, when charge compressed to 15 pounds above atmospheric pressure? Can you give rule or formula for determining above? Would there be much difference between theoretical and actual pressure? A. One gallon of gasoline produces from 60 to 80 cubic feet of vapor, according to the temperature and density of gasoline. From 5 to 6 volumes of air per volume of vapor is used, and even 12 volumes is claimed as the most economical mixture of air with gasoline vapor for explosive power effect. The explosive pressure varies with the ratio of mixture of air and vapor, and also with the ratio of charge volume to the volume of the cylinder; in practice it varies from 90 to 150 pounds per square inch. Compression, as in the four cycle engine, adds its own pressure to the explosive effect and increases the mean piston pressure in a large degree. The theoretical pressure is somewhat greater than the actual pressure, owing to the uncertainty of perfect mixture in the gases and undefined limit of absorption of heat in the cylinder walls. See Donkin's work on "Gas and Petroleum Engines," $6.50 by mail.

NEW BOOKS AND PUBLICATIONS.

THE FORCES OF NATURE: A STUDY OF NATURAL PHENOMENA. By Herbert B. Harrop and Lewis A. Wallis. Columbus, Ohio: Harrop & Wallis. 1895. Pp. 159. 12mo. Illustrated.

The preface says: "There is a class of persons who have acquired a thorough knowledge of their special callings and who would become better acquainted with Mother Nature in all her aspects if this acquaintanceship might be brought about without tedious delving among learned volumes which they have probably neither the time nor the inclination to read. Bearing in mind these facts, we have attempted to supply all necessary explanations, and to solve the problems which these difficulties present, with what success remains to be seen."

ALTERNATING ELECTRIC CURRENTS. By Edwin J. Houston, Ph.D., and A. E. Kennelly, Sc.D. New York: The W. J. Johnston Company. 1895. Pp. 225. 16mo. 77 illustrations. Price $1.

This is the first of ten volumes of an "Elementary Electro-Technical Series," designed to give concise and authoritative information concerning those branches of electro-technical science having a general interest. The subjects to be treated are alternating currents, electric heating, electro-magnetism, electricity in electro-therapeutics, arc lighting, incandescent lighting, electric motors, electric street railways, telephony, and telegraphy. The authors state that though the several volumes form a series, each is, nevertheless, so prepared as to be complete in itself, and can be understood independently of the others. The authors of "Alternating Electric Currents" treat the fundamental principles underlying this difficult branch of electrical engineering in the simplest language and without the use of mathematics any further advanced than ordinary arithmetic.

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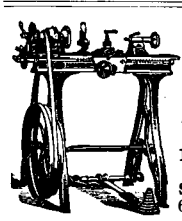

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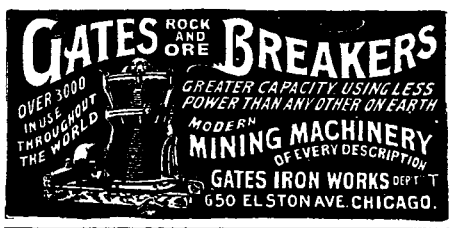
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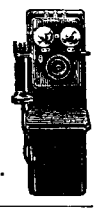

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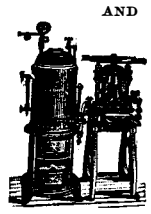

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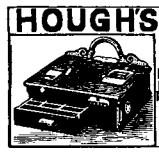

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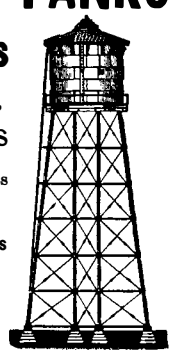

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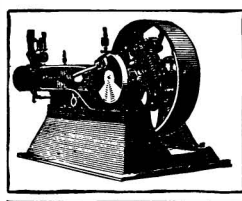

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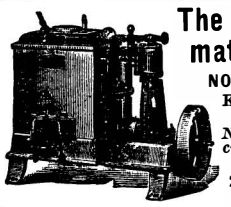

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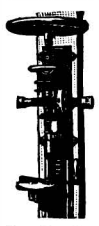

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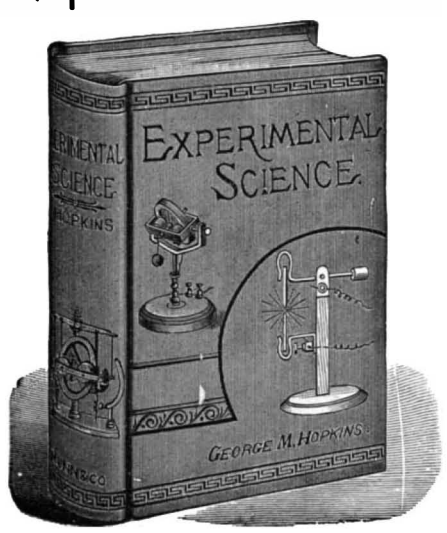

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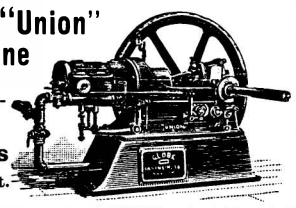

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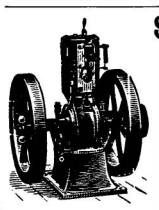

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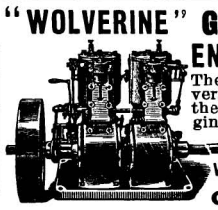

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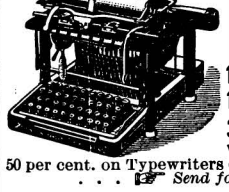

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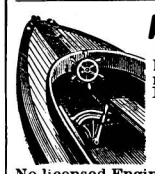

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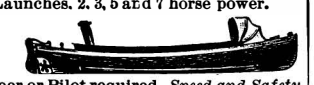

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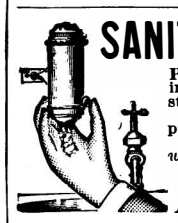

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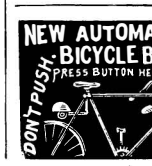
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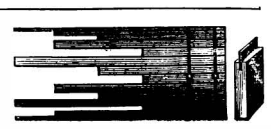

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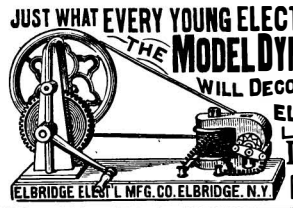

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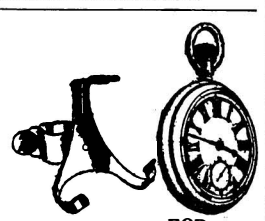

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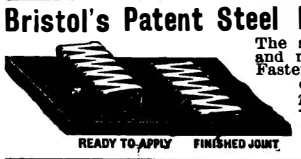

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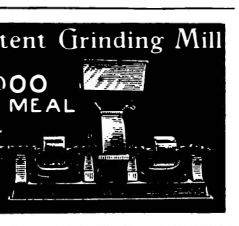

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